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THE PROBLEM OF THE AUXILIARY SHIP

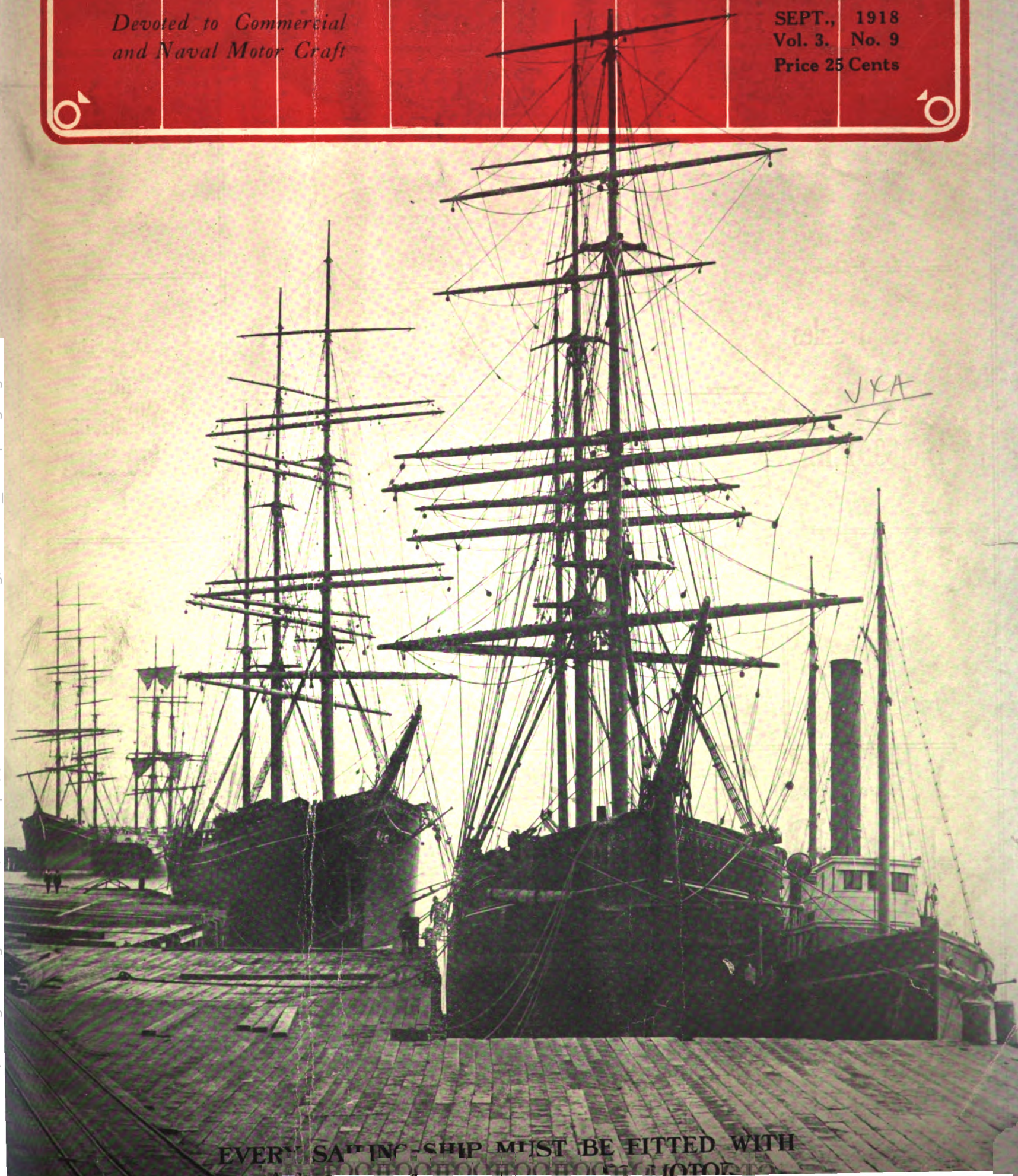
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SEATTLE

# MOTORSHIP

*Devoted to Commercial  
and Naval Motor Craft*

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EVERY SAILING SHIP MUST BE FITTED WITH

# MOTORSHIP

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## EDITORIAL

*The oil-engined motorship has arrived! It is such a pronounced economy that it was bound to come. Nothing could stop it! And all obstacles have been removed as fast as they arose. The law of progress has seen to that. Very strong prejudices stood in the way of steam. But, one after another they were swept aside and steam reigned triumphant for a century. Steam now has had its day! Its zenith has passed, and gradually but surely it is being superseded by the economical internal-combustion power. America, the most important oil-producing country, is to be the greatest motorship-owning nation. Let us all co-operate and assist to make that day soon*

### THE IMPORTANCE OF AUXILIARY POWER FOR EXISTING SAILING-SHIPS

IN placing orders for 36 large steel-built Diesel-driven ships, the U. S. Shipping Board Emergency Fleet Corporation made the most commendable and far-seeing steps taken since the Government entered the merchant shipbuilding world, and the same will be one of the greatest factors towards winning the war and simultaneously establishing the commencement of America's after-war mercantile-marine supremacy.

But, there are two very important things yet to be done. One of them is the installation of auxiliary propelling motor-power in every suitable existing U. S. sailing-ship and in every U. S. sailing-ship now under construction. There is still a tremendous shortage of cargo-ships needed for the coastwise and overseas transportation of American products, supplies, and munition; also for the transportation of Australia's vast quantities of accumulated wheat.

This auxiliary power is needed to double the annual carrying-power of all sailing-vessels; to render them virtually independent of tug-boats, of which there is a shortage; to render them independent of wind and tide; and to avoid delays caused by calms, adverse tides, and adverse winds. For instance, the fine sailing ship "Dunsyre" recently took sixty (60) days longer than the motor auxiliary "City of St. Helens" to sail from Sydney, Australia, to San Francisco. Many similar comparative voyages are detailed elsewhere in this issue.

There are on the market ready for delivery sufficient new, or slightly used, heavy-oil, distillate, and kerosene marine motors to equip at least 20 large and medium sized sailing-vessels with auxiliary propelling power, which other engines could be obtained in a very few months. In fact, many commercial marine-motor builders would be overjoyed to take on large orders.

Furthermore, a ruling should promptly be made, prohibiting the construction of any sailing-ships without auxiliary propelling motor power, except with special permission of the Emergency Fleet Corporation, and we hope that the U. S. Shipping Board will quickly issue this rule. For some little time we have been anticipating such

a ruling and should not be surprised to see it in force by the time this appears in print, as the matter is one for speedy action.

The second important step yet to be done is the installation of a motor-driven electric-lighting and wireless emergency-set above deck of every American ship, whether she be a freighter, liner, war-ship, sailing-ship, tanker, or motorship. Nothing is more awful than the terrible darkness on board a torpedoed ship at night with the main machinery out of action, and without means to signal for help. Also we must not forget how a German U-boat recently calmly helped herself to about 80 tons of badly-needed copper from a ship helpless to signal for assistance, although close to the U. S. coast, and then sunk the ship, together with the remainder of the copper.

There are many small marine-motor manufacturers who can undertake the construction of such emergency installations, which will only cost a few hundred dollars to make and the installation of which will in no way delay a ship in port. Surely the lives of our gallant merchant seamen are worth the value of a emergency electric-lighting and wireless outfit?

### LIGHT UPON THE AUXILIARY SHIP QUESTION

"Motorship" recommends that no shipowner, or naval architect, should fail to read the discussion on another page of this issue entitled, "The Problem of the Auxiliary Sailing Ship," which deals in a practical manner with a class of merchant vessel over which there has been displayed misunderstanding, in some instances almost bordering on ignorance, with the unfortunate result that there is an impression prevalent that the motor auxiliary sailing-ship is unsuccessful as a type. No greater misconception could have arisen, and the article in question should do much to shine light upon the real cause for those vessels having given unsatisfactory operation, and to prevent re-occurrence of past mistakes. To this article we also respectfully draw the attention of the officials in charge of constructing America's great new merchant marine.

## EDITORIAL—Continued

## VITAL NEED OF PUBLICITY AND PREPARATION FOR AFTER-WAR TRADE

**A**MERICA is extensively participating in the greatest war known to the history of the world. All her energies are being devoted to successfully ending that war, and in order to do so almost the entire nation is being called upon to make great business sacrifices. But, amid the turmoil and rush of war work it is vitally important that we should prepare for peace in every possible way that will not interfere with war production, because America must emerge from this war fully prepared to do a world-wide business, and with her merchant and manufacturers completely in touch with the markets of all countries. In other words—while our shipyards, engine-works, steel-mills, textile-factories, etc., are turning out products of war, they must keep their names and trade-marks constantly before the eyes of domestic and foreign traders, otherwise, after America has given the lives of hundreds-of-thousands of her sons, and hundreds-of-billions in money, there is a possibility that Germany eventually may outwit us in world-wide trade after we have thoroughly beaten her on the battle field and on the high seas. Then all America's gigantic efforts to thrash Germany in one way will have been wasted!

This country must emerge from the war very strong from a foreign trade and domestic business point of view, and recently Mr. Edward N. Hurley, Chairman of the Shipping Board, very clearly summed-up the situation in a few words. Mr. Hurley said: **"We are building ships not alone for the war, but for the future world trade. Other nations are making ready to meet the conditions that will arrive with peace. When ships are ready for commerce after the war, will each merchant and manufacturer be ready for greater over-seas enterprises?"**

Under the difficult circumstances now existing the best method to keep the products of this nation's manufacturers before the eyes of the world is by judicious publicity in good trade publications and by the U. S. Government encouraging the distribution of these journals throughout the United States and all over the world. Attending to such publicity will occupy but little man power and comparatively costs but little, as well drafted advertisements speak and create lasting impressions.

Many companies, particularly shipyards and marine-engine works who are doing Government work exclusively, unwisely have withdrawn from all publicity; some because they have no capacity nor desire ordinary business at this time, or because their contracts with the Government do not allow of reasonable advertising being included in their overhead costs.

Such concerns will have very great difficulty in resuming their normal business after their Government contracts have expired (particularly as they have dispensed with their salesmen and their agents), because they will be completely out of touch with ordinary markets and because other more enterprising companies will have stepped-in and taken away their old customers. In the case of business abroad, we must remember that allied and neutral countries for their own preservation now are making strong attempts to prepare for the future. Even France, whose man shortage is most serious, has considered it advisable to send at this time a special commission to Australia for the purpose of establishing after-war business and trade relations. Both Great Britain and Italy have just sent similar commercial missions to South American countries.

In all cases where shipbuilding and marine engine building and auxiliary machinery companies have their out-puts devoted to Federal contracts, it is perfectly logical, reasonable and fair that the Government indirectly should stand the cost of a certain amount of publicity. If these concerns were doing work for private owners, the latter would have to bear the cost of all general advertising carried, and, as the Government now is taking the place of private ship-owners, so it should bear this burden.

Therefore, all Government contracts should allow the overhead charges to include the cost of advertising equivalent to the space carried by said contractors before the Government contracts were accepted. It is unreasonable and illogical to expect firms with Government contracts to pay for publicity out of net profits. Such is unbusiness-like in the extreme, particularly as these profits are subject to heavy war taxes and the balance is required for purchasing Liberty Bonds, and for living purposes.

As the entire out-put of hundreds of companies are devoted to national work, undoubtedly it is the nation's duty to assist these concerns to prepare for future business and trade. We are glad to say that as we write we learn that the U. S. Emergency Fleet Corporation are giving this question very serious consideration, and from what we know of the officials, we are convinced that they are broad-minded enough and have sufficient foresight to adopt a policy which conforms with the suggestions that we have outlined above. Meanwhile, all shipbuilders, engine-builders, and accessory manufacturers

should continue with their pre-war advertising even if at the expense of their own profits. This is vital for their future.

Perhaps it is well to quote the words of a prominent Philadelphia manufacturer who hits the nail squarely on the head:

"If the American manufacturer becomes over-cautious and cuts down his advertising and other items essential to his business there is going to be a condition of depression that will ruin America's chances of seizing a goodly portion of the world trade. There will be an era of prosperity for business in general following the war. A short period of readjustment will come right after the close of the war, but after that there will be heavy buying. Then will follow the grimmest kind of competition, and it will be then that those who in time of war prepared for peace will be best equipped to stand the fight."

This man is preaching preparedness for the business to come and is practising it. His firm is making new connections in foreign markets and is building up a larger organization, which is practically useless now. Let everybody connected with the shipbuilding, engine-building and allied trades give profound thought to this most serious matter, and let all Departments of the Government assist in every possible way.

## NEW TYPE OF BRITISH MOTORSHIP

## Welded-Steel Hull with Opposed-Piston Oil-Engines

We are able to state that Cammell Laird & Company, the well-known British shipbuilders, are constructing an entirely new type of oil-engined motorship. The hull is electrically welded, so is rivetless, and there is being installed as propelling-power the new Cammell Laird-Fullegar marine heavy-oil engine, which is of the opposed-piston, two-cycle, direct-reversible, type. We hope to have more to say about this most interesting merchant-ship in an early issue. It points to a new era in shipbuilding.

## ENGINEERS OF MOTORSHIPS AND AUXILIARIES

At the present time a number of chief-engineers and first-engineers of the big American motorships and auxiliaries, are men who have been given their positions without having worked their way up in the successive stages of fourth, third, and second engineers as they are obliged to do aboard steamships. These men are enabled to obtain chief's certificates by reason of having their old tickets for running the machinery of comparatively small commercial gasoline-launches. It may be that many of the unsatisfactory operations of some vessels are due to the inexperience of some of these men. No shipowner would expect the chief-engineer of a large steam-engined ship to produce satisfactory results unless he had been through the successive grades. The matter is one that needs an inquiry.

## CHARLES PIEZ AND SHIP'S MACHINERY

Someone has criticized the U. S. Emergency Fleet Corporation for not having laid-down a "sufficient" number of concrete ships, and the U. S. Shipping Board has just issued a reply emanating from Mr. Charles Piez, General Manager of the Emergency Corporation. Among other things Mr. Piez says that the critic—

—"fails to recognize that, because of the limitations in our power and ship equipment producing capacity, our output of ships is measured by the number of vessels we can equip rather than by the number of hulls that we can launch. Facilities for the production of power equipment, deck equipment and other ship equipments, have steadily been added to and the production is constantly increasing, but, even today, the hull producing capacity of the country in steel and wood ships is in excess of what may be termed the power and equipment producing capacity for fitting out these ships. The writer loses sight of the fact that only sixty per cent of the total labor is connected with the hull construction and that fully forty per cent of the total labor input is connected with the installation of machinery and equipment. The labor connected with the installation is the most highly skilled and most difficult to secure, and on this account any considerable expansion of the concrete shipbuilding program would interfere immediately and substantially with the program of ship construction now under way."

Mr. Piez's statement is too lengthy to publish here, but there is much in which we agree, and we sympathize with the many difficulties before the Emergency Fleet Corporation officials. However, we respectfully draw Mr. Piez's attention to the fact that the order for 72 Diesel engines recently placed, while admirable, by no means drains the resources of the domestic marine oil-engine industry, and many firms would be glad of orders for propelling and auxiliary engines for ships. Also one or two engineering companies of neutral countries will gladly turn over the greater part of their output to the U. S. Government if they are allowed to obtain the necessary raw materials.

# The Problem of the Auxiliary Sailing-Ship

Lack of Success With Some Vessels of This Class Principally Due to Absence of Proper Recognition of the True Use of Auxiliary Power—The Coming of the Large Steel Auxiliary!

**A**LTHOUGH there lately have been built in this country a number of auxiliary motor-powered vessels that have not been so successful as was expected, the same offers no reason for claiming that the motor auxiliary sailing-ship is not a success; because, if properly designed and adequately powered, such craft can be run in competition on the high-seas with the most modern of steel steam-driven freighters, with results unquestionably in favor of the motor auxiliary. This is a definite and established fact and it is difficult for anyone to raise a logical argument to the contrary.

During the last few years the unprecedented demand for bottoms has caused the indiscriminate construction of a considerable number of large wooden motor-auxiliary schooners, many of which have been designed, built and placed in service without proper study of the subject of auxiliary power, with the result that some of these vessels have been failures and some of the others not fully satisfactory. Whereas, if proper knowledge of the conditions has been displayed at the outset, there is no real reason why the same should not have been ultra successful.

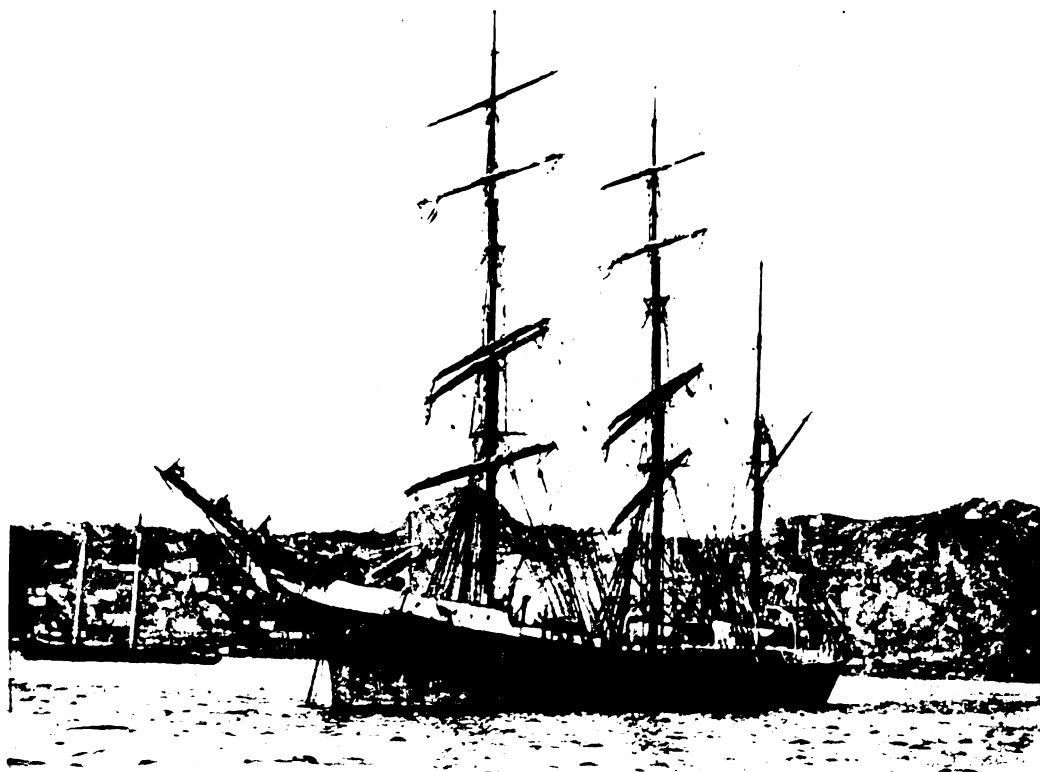
A few ships have proved a disappointment purely because of faulty installation work, or because of propelling machinery of untried design built by manufacturers who had practically no knowledge of the essential requirement of marine work. However, as the latter two cases do not materially effect the value of the auxiliary ship, but merely are individualized instances, we need not discuss them at the moment. No one will condemn steamships because of a few badly-built geared-turbine vessels, otherwise hundreds of American merchant steamers now constructing would have to be abandoned; for, there certainly have been some geared-turbine installations recently built that are considered by a prominent shipbuilder to be a disgrace to the engineering sections of the nation. And, had these said ships been Diesel-driven motor-vessels, there would have been a great outcry. Whereas, these new steamers have been quietly laid up for several months and repaired or altered.

We mention this solely to make it clear that we do not condemn the geared-turbine from an engineering point of viewpoint because a few ships thus equipped have been unsuccessful. But we do maintain and can demonstrate that the steam turbine ship cannot possibly compare with the motorship, or auxiliary, from an economic aspect.

To continue with the problem of the auxiliary ship. Had all shipowners followed the recommendations put forward in this journal at various times, some of them would have saved themselves disappointment and many thousands of dollars. The subject is one to which we have for many years given not a little thought and study, and our suggestions always are at the disposal of the shipowner who desires to avail himself of the same, even if not followed.

It seems that some shipowners have failed to grasp the important distinction between a motor auxiliary-powered sailing-ship and a motorship with auxiliary sail power. These are two vastly different types of craft and the best to adopt rests largely with the special conditions of service under which a vessel will operate. These owners have built a motor auxiliary-powered sailing-ship and

strained, and the owners become disgusted. Yet the blame in such instances lies with the original owners or their advisers. Even with such ship there are people who infer that the trouble is due to a fundamental fault of the auxiliary ship or of the oil-engine system of propulsion; whereas this is not so, the motors having had to operate under exceptionally difficult and serve circumstances—



An auxiliary of this type does well under canvas, but she should have at least 250 b.h.p. This is the "Madeline" Constance," a vessel of 550 tons d.w.c., fitted with one 160 b.h.p. Bolinder oil-motor. Owned by W. S. Job & Co. of N. Y. C.

have tried to make it do the work of a full-powered motorship fitted with auxiliary sail power.

Again some so-termed auxiliaries have been neither one thing or the other. That is to say, they have had insufficient motor power to drive them under power alone, and an inadequate spread of sail that could not give them economical speed when under sail alone. Consequently they cannot make a decent speed even with sail and power simultaneously in use. The crew are overworked and discontented, the machinery is overloaded and

conditions under which steam power rarely has to contend with.

Speaking of steam power, it is our conviction that the steam-auxiliary ships now under construction in this country for the French Government will be far from completely successful, and that after the war they will be unable to compete with motorships, or motor auxiliaries, and perhaps not against full-powered steamships. Actual service soon will show if our belief in this respect are correct.

In order to ensure successful results the shipowners, when planning an auxiliary sailing-ship, has to decide definitely that the ship is to be operated as a vessel with auxiliary motive power. This is to say, the sails should be solely relied upon at all times when the speed of the vessel exceeds 8 knots. This, unless the boat be a small one of under 1,000 tons, where 7 knots will do.

Therefore, sufficient power must be installed to give the vessel an average loaded-speed through still, salt water of at least 8 knots, without overloading the engine and without using the sails. This will give a fair speed against adverse winds and tides and a very reasonable speed during calms. This power should not be used when the vessel is sailing at 8 knots or more on her proper course, and captains should be given strict instructions accordingly. Also she should have enough canvas to give her an efficient speed without the help of the motor when the wind is favorable.

Such an auxiliary should not be expected to compete against a full-powered steam vessel of 9-11 knots average speed, although on many occasions she will be able to do so. But the enormous advantages of a motor-auxiliary sailing-ship over a sailing-vessel that has no power, are apparent, especially if the auxiliary can maintain a speed of not less than 8 knots and sometimes up to 16 knots. That is why every suitable sailing-ship now in service should be equipped with auxiliary oil-engine power by order of the U. S. Government. Then no longer will they become becalmed for weeks, or driven back over their course by adverse winds and tides.



A motor auxiliary steel schooner "Pusey Jones II." built at Wilmington, Del. She has as auxiliary power one 120 b.h.p. oil-engine.

Except on very special routes a full-powered motorship with auxiliary sail power is not advisable, as the straight, full-powered motorship generally will prove more economical to operate. In this connection one has to be careful to ascertain where to draw the line and distinguish between a high-powered auxiliary and what is virtually a full-powered vessel with sails.

To be successful on average ocean-going trade routes an auxiliary ship of about 4,000 tons loaded displacement and of about 2,750 tons dwt. should have about 1,000 shaft horse-power and about 14,000 sq. feet of sail area. Then, if properly designed, she will be able to maintain an adequate speed under either power or sail.

"Motorship" is of the opinion that in a few years after the war we shall see a considerable number of very large steel-built auxiliary Diesel-driven sailing-ships, especially on the Pacific Ocean routes where the winds are favorable to sailing-

ships. These will be vessels of about 11,000 tons loaded displacement and 8,000 tons actual cargo-capacity (500,000 cubic feet approximate). They will be equipped with crude-oil motors totaling 2,000 b.h.p. and will carry a spread of about 80,000 sq. feet of sail. Their total crew will not exceed 57 men, engineers and officers, and in addition to the above cargo will have sufficient fuel-oil for 25,000 nautical miles under power alone, or say 100,000 miles if the sails are properly used. Their loaded speed will vary from 8 knots under power alone to as much as 17 knots under sail, or say an average loaded-speed of not less than 12 knots under ordinary conditions. The fuel consumption will be about 55 to 60 barrels of heavy-oil per 24 hour day maximum when sails are not being used and if four-cycle type engines.

A vessel of this description easily can more than hold its own against anything steam-powered afloat. The big French Diesel-driven auxiliary

"France" is almost as large as the above and her success is undisputed, although she is a pioneer of her class and was built six years ago. For long distance voyages these big auxiliaries are especially suitable, also for the South American trade. But they are not adapted for short voyages.

As it only is a question of time before the large auxiliary Diesel-driven steel sailing-ship comes into its own, we should like to see the U. S. Shipping Board Emergency Fleet Corporation order at the earliest possible moment a fleet of 20 for the Pacific trade. It would be no experiment, but an undoubtable success from the start. Each such vessel will carry at least 2,000 tons more cargo per voyage than will full-powered steamships of similar dimensions, so the proposed fleet would be equivalent to about 24 steamers, or, saving of steel, labor, and money equivalent to four ships of this tonnage, apart from the enormous saving in fuel. Surely this is well worth an investigation?



Using but sixty-three barrels of crude-oil fuel per 24 hour day, this motor auxiliary sailing-ship can carry 7,500 tons of cargo in addition to sufficient fuel for 20,000 miles under power only, at a speed of 8½ knots loaded, or up to 17 knots with sails. She is the Diesel-driven auxiliary "France," fitted with two 900 b.h.p. Schneider engines. How can any modern steamship compete against a little larger vessel of this type that has more motor power and speed?

## Ten-Thousand Ton Motor Auxiliaries Are Vessels of This Class the Best Type of Cargo Carriers?

NO motor-driven vessels received greater notice in the lay press than the big French steel-built, five-masted Diesel auxiliary "France" during her visit to New York harbor. The New York "Sun" even arose to the extent of an editorial of romantic nature over her that terminated thusly:

"There is something about the white wings of a great sailing-ship that takes the beholder's breath away a little quicker than the biggest passenger steamship or even the gray mass of the man-o'-war. The unmatched splendor of the sight of a great ship under full sail is one of the fine spectacles of a past generation; when such a visitor as the 'France' comes from overseas and rests upon our harbor waters for a little while, it quickens the blood."

Romance in these days unfortunately must be left to writers of novels of the sea, for the modern shipowner's first thought is dividends. However, though a ship like the "France" may bring back romantic thoughts of the old clipper days it is possible that she may be a very desirable type of ship for the Atlantic and Pacific trades, so it is well first to probe deeply into the question of her feasibility before letting her pass out of sight with a reluctant sigh.

Over six years working of the "France" has shown, without doubt, that she is a practical and profitable ship; but whether she can show any advantage over the full-powered Diesel motorship is entirely another matter. But there can be no

doubt, whatever, that under ordinary ocean-going conditions she is a far more economical carrier of freight than is the usual full-powered steel steamer of her size, whether coal or oil burning. She was built for special long-distance service that made a steamship absolutely unpractical for the work; and, as she since has been placed in service, where in a sense she is in competition with full-powered motorships and steamers, another aspect arises.

Perhaps it is well to place her advantages and disadvantages side by side, and weigh the total points against each other. Here is a vessel of 10,500 tons displacement that carries 7,500 tons of actual cargo in her holds.

### Disadvantages

- (1) Slightly higher cost of construction for her dimensions than a steamer or full-powered motorship.
- (2) Large deck-crew needed as well as engine-room staff.
- (3) Valuable machinery (representing capital) idle when travelling under sail alone. Also engineers virtually idle or non-productive.
- (4) Deck-crew being paid when running ship under power only.
- (5) Tendency of owners and crew to use the auxiliary power continuously as if she were full-powered vessel, and thus over-strain the machinery in addition to not securing the maximum possible economy.
- (6) Great sail and rigging upkeep charges.

### Advantages

- (1) Lower cost of construction per ton of cargo carried than a steamer or full-powered motorship.
- (2) Stokers of a steamer dispensed with.
- (3) No fuel bill when under sail alone.
- (4) Low fuel costs when running under power alone.
- (5) Minimum speed nearly 9 knots in average weather or calms.
- (6) Maximum speed nearly 17 knots.
- (7) Average speed about 12 knots.
- (8) Comparatively low first costs of machinery for vessel of this size.
- (9) Enormous cruising radius, which practically is unlimited and only is restricted by food and drinking water supply.

To sum the matter up, here we have a ship that carries 7,500 tons of cargo (exclusive of fuel and water) at an average speed of at least 12 knots on a trans-Atlantic or trans-Pacific voyage, and with a maximum fuel consumption of but 63 barrels of oil per 24 hour day, or, say an average voyage consumption of 40 barrels (6 tons) per day, because the engines are only used part of the time.

To assist her to maintain this speed she has a tremendous amount of canvas and a large deck-crew. Now, by dispensing with the masts, yards, sails and many of the deck-crew, and slightly increasing her overall dimensions, and adding 100 per cent. to the power, and installing Diesel engines of slower speed than those now fitted, she still would carry at 7,000 tons of cargo.

(Continued on page 22)

# Some Voyages of Auxiliary Sailing-Ships

## Comparisons of Their Operations with Sailing-Vessels Without Motor Power

EVERY shipowner must know in his heart that an underpowered and undercanvassed motor-auxiliary sailing-ship cannot do the work expected except under the most favorable of conditions, yet many of the ships lately built may thus be classed. This is partly due to a desire to economize in the cost of sails and propelling machinery and partly to lack of experience and knowledge,

same time from Sydney, Australia, the fine sailing-ship "Dunsyre" and the oil-engined auxiliary sailing-schooner "City of St. Helens." It hardly needs further comment when we mention that the "Dunsyre" took 60 days longer than the motor-auxiliary to reach San Francisco, Cal. Similar results applied to several other ships that lately have made the same voyages, demonstrating the splendid ad-

that the U. S. Emergency Fleet Corporation order all existing sailing-ships to be installed with auxiliary motor power?

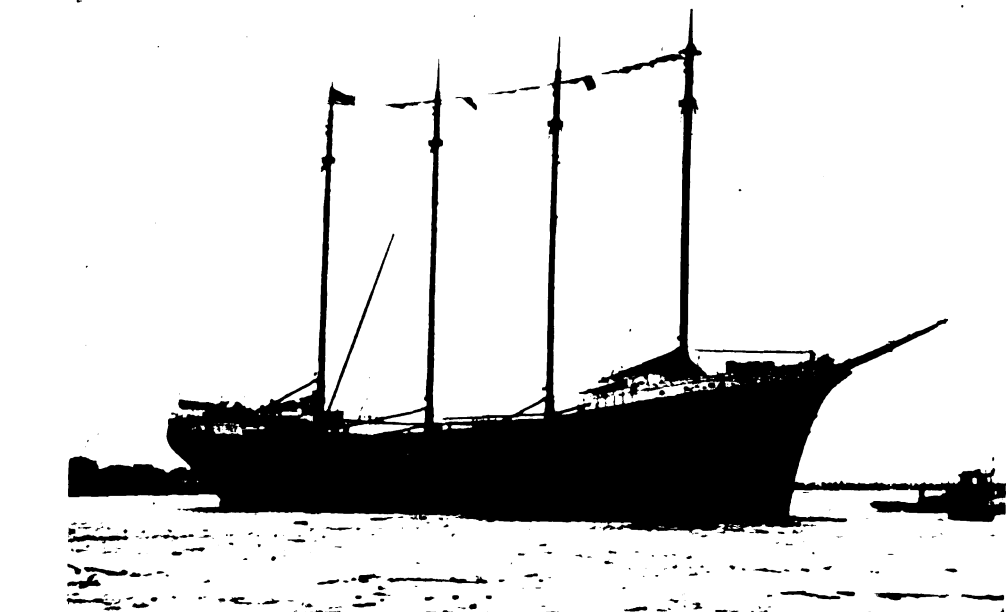
The motor auxiliary "S. I. Allard" owned by Chas. R. McCormick & Co., has just completed a fast voyage from Seattle, Wash., to Philadelphia, Pa., and since has averaged about 7½ knots, which run a sailing-ship may not equal once in a hundred voyages, as the winds and currents rarely are favorable throughout such a long voyage. She also came down from Boston to New York in 42 hours, although held up by fog. Also the motor-auxiliary "Sierra" made a fast trip from Seattle to Callo, S. A. Not long ago the Senate Committee on Commerce were told by an Emergency Fleet Corporation official how the motor-auxiliary "City of Orange" made a speed of 17 knots in the Mediterranean Sea and left the convoying warships far astern.

In a voyage from San Francisco, Cal., to Portland, Me., the oil-engined auxiliary "City of Portland" only took 32 days, making the first lap to Colon in the excellent time of 14 days. The same ship made a trip from Portland, Me., to Savannah in 4 days, 14 hours—or an average of nearly 10 knots for the entire distance of 1,055 miles. This ship can carry 3,300 tons of cargo, in addition to fuel, with but a maximum fuel-consumption of but 24 barrels of heavy-oil. Yet, as we previously have pointed out, her owners agree that she is underpowered. With a little more power to her auxiliary engines she would put up even better performances.

On a run from 'Frisco to Balboa, C. Z., a total of 3,245 miles, this same auxiliary ship averaged 7.74 knots. From Savannah, Ga., to New York, N. Y., she averaged 7.26 knots. From March 13th, when she left the Pacific Coast, not a penny was spent on repairs to the propelling engines, no trouble being given.

The motor-auxiliary sailing-ship "City of St. Helens" has just lately completed a remarkable voyage from Astoria to Port Pirie, South Australia, returning to San Francisco via Sydney, the total distance covered being 17,600 knots, which was made in 108 days, the last lap of the voyage being made in 45 days. On arrival here, the ship was examined and every bearing was found to be in the very best of condition, and the surfaces of the cylinders and injection-bulbs completely free from carbon. While in Sydney she was supplied with fuel-oil of poor quality and low gravity, less than 170 degs., which was used for a large period of the return trip without apparently being any way detrimental to the working of the engines.

If space permitted many other interesting accounts of successful voyages of auxiliaries could be given, demonstrating in an undisputable manner the great advantages of the auxiliary over the sailing-vessel and which clearly show the auxiliary to be a sound type of ship.



The 2,500 ton d.w.c. motor-auxiliary "Admiral Sims," built by the Puget Sound Bridge and Dredging Company. She is a sister ship to the "Admiral Mayo." Both vessels are powered with two 360 b.h.p. Skandia oil-engines.

with the result that the combination of false economy and errors of judgment have produced uneconomical and unsatisfactory craft.

However, there have been some auxiliaries recently constructed that are only a little underpowered and these vessels at times have given performances bordering on the work of the average plodding tramp steamer. With these particular ships the owners frankly admitted that more power should have been installed, and that they would have done so had they been able at the time to get larger engines of the same make. Unfortunately the builder of the particular engine desired had not then produced a larger model, so the smaller motors were installed. For their latest ship they ordered higher power but the engines have not yet arrived from Sweden, so she will go in service for a while without power. Some of these ships are included in the performances that now follow.

A little earlier this year there sailed about the

vantages of the auxiliary-powered vessel.

In the Pacific service there are two very well-known sailing-ships, namely, the "Falls of Clyde" and the "Marion Chilcott." About two years ago their owners—the Associated Oil Company of San Francisco—were seriously considering installing auxiliary oil-engine power. But, for some reason known only to themselves they did not do so, so the ships have remained in service without power.

During this period the oil-engined motor auxiliary sailing-ship "Annie Johnson" has been running regularly as a freighter from 'Frisco to the Hawaiian Islands, averaging as fast as 12½ days for each trip. On a recent voyage back from the Islands she beat the "Falls of Clyde" by 15 days; and beat the "Marion Chilcott" by 17 days on a trip to the Islands, so that her annual carrying capacity must work out at over 100% greater than either of these two sailing-vessels. Is it any wonder that "Motorship" is strongly advocating to

view, and in urging British shipbuilders to march with the times they were performing what they thought was a duty.

He also referred to the establishment of a new German shipbuilding company, of which Herr Ballin was president; and which had great financial backing. It was to specialize in the construction of ships run by oil-motors. It was impossible to overrate the significance of the announcement. Remember that all the submarines proved capable of such sinister activity were run by internal-combustion-engines, and the Germans, already wide-awake to the importance of this motor, had learned a great deal more about it during the war.

### ENGINE-ROOM CREWS OF AUXILIARIES

Someone has said that motor auxiliary sailing-ships of American register never will be successful from a shipowner's point of view so long as the present shipping laws are in force, whereby an auxiliary must carry three engineers. While we fully agree that the laws need radical revision, we do not think that this particular ruling will effect auxiliary ships of the larger type, although it is more important where sailing-vessels of 100 to 800 tons d.w.c. are concerned, with which an engineer and a boy may be sufficient, particularly with a coastwise—trading ship.

In the case of a large ocean-going auxiliary sailing-vessel, oil-engine machinery of 600 to 1000 horse-power or more, costing from \$120,000.00 to \$200,000.00 deserves and needs three engineers, especially on long distance voyages, otherwise how can satisfactory operation be expected?

The wages and food of three men will cost about \$5,500.00 per annum and if auxiliary power did not mean ten times that amount in extra earning power, we would not advocate the same; but would advise owners not to install auxiliary motors in their sailing-vessels.

The law needs changing whereby the number of engineers should be in accordance with the size of vessel and horse-power installed, also full-powered ships should not be taken as a comparison, because the machinery of auxiliaries may be idle for several days at a stretch when fair winds are prevalent.

### SIR MARCUS SAMUEL AND MOTORSHIPS

#### The Warning of a Far-Sighted Shipowner

Sir Marcus Samuel, Chairman of The Shell Transport & Trading Company and a well-known English ship-owner, recently said that his company has endeavored by pioneering to bring home to British shipbuilders the importance of the internal-combustion-engined ship, and that he saw with misgivings the creation of a large fleet of standard ships constructed to run on steam engines, because he felt sure that they could not compete with ships with internal-combustion-engines, which were being manufactured on a gigantic scale by the Germans, the United States, the Danes, and the Swedes.

Sir Marcus said that he hoped Lord Pirrie, who had successfully built internal-combustion-engines himself, would give the greatest heed to this important question. At all events, this company was determined to provide oil-stations wherever they were required, feeling quite confident that the future would develop more and more the need for oil. Placed as their fields were throughout the world, they were in the position to furnish these requirements better, he thought, than any company or any combination.

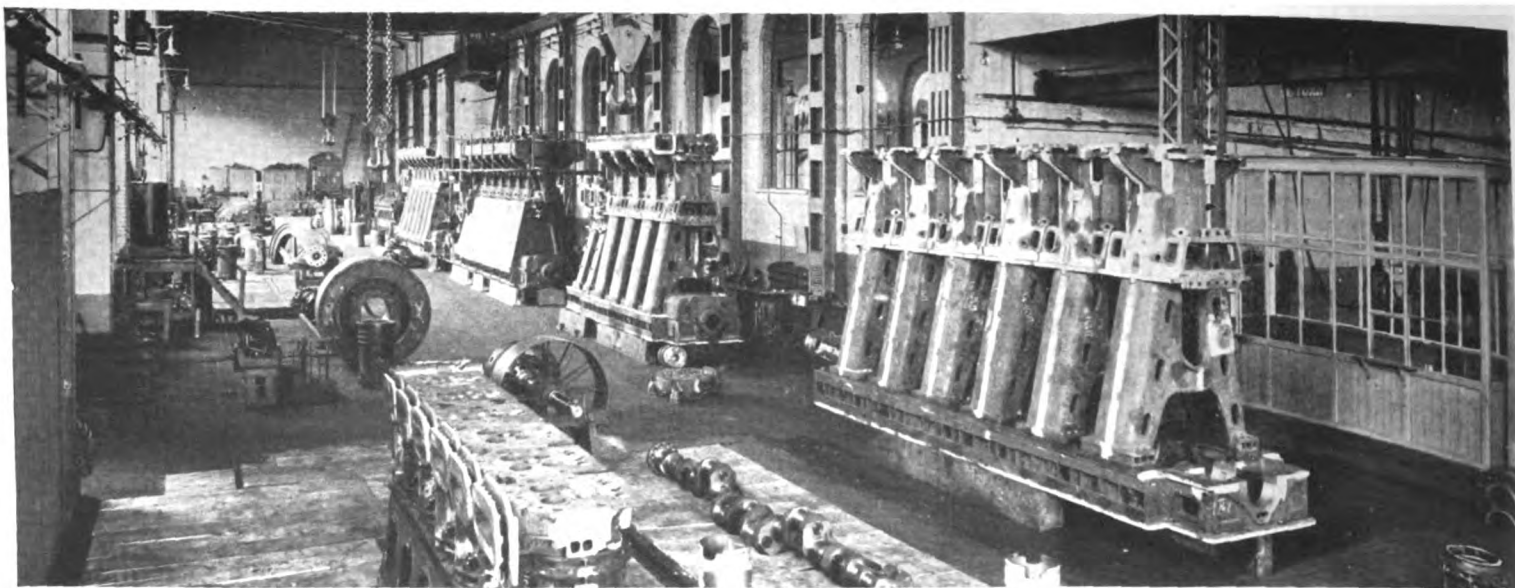
Let it should be thought that in calling attention to the internal-combustion-engine, they were urging their own selfish interests he must tell them that, from their commercial point of view, it was infinitely better that vessels should burn oil under boilers rather than use it in internal-combustion-engines, since the offtake by that means would be 4 to 1 (because of the economy of the latter), but they for themselves took a broader and wider

### MORE MOTORSHIPS THAN STEAMERS BUILDING IN NORWAY

According to the Norske Veritas, these were on order and under construction on July 1st, 1918, the following ships:

	Under Construction		On Order but Keel not Laid	
	No.	Gross tonnage	No.	Gross tonnage
Steamers, steel.....	45	49,960	92	143,440
Steamers, wood.....	11	2,340	6	1,955
Motorships, steel...	7	9,415	3	1,070
Motorships, wood...	80	23,280	18	7,580
Motorships, concrete	14	6,440	13	4,970
Total.....	157	91,435	132	159,015

It will be noted that there are no fewer than 101 motorships of 39,135 tons gross, compared with 56 steamships of 53,300 tons gross, actually under construction. The total motorships building and on order number 135 bottoms.



A view of a Diesel-engine erecting shop at the Franco Tosi works showing four merchant marine and two submarine oil motors under construction

## Random Remarks on Modern Marine Diesel-Engines Together With Some Technical Details of the New Tosi Merchant Marine Diesel Engine

By H. R. SETZ

ON page 20 of the June issue of "Motorship" appears a statement which takes exception to some figures I presented in an article in the March number of the same journal, on "The Diesel Engine and Our Merchant Marine." The contributor of this statement thinks that the engine proportions I was using as a basis of my arguments differ materially from existing practice and that my proposed engines would therefore lack in efficiency as compared with established standards. To arrive at such a conclusion on the mere fact that the stroke to bore ratio of the engine which I suggested is around 1.5, whereas that of the engines which are cited as apparently of typically European design show a ratio of around 1.70, seems rather far-fetched.

In the first place, it has, as far as I know, never been possible to conclusively establish any positive or measurable relation between the stroke to bore ratio of an engine and its efficiency, certainly not within the range given above and on engines of the type here considered. Likewise as a problem of quantitative analysis the subject defies all attempts at mathematical treatment with our present limited knowledge, except perhaps as a very abstract problem of applied thermodynamics under a number of limiting assumptions.

The only way of discussing this question, then, is on the basis of a qualitative analysis, which I endeavored to do as far as it had any bearing on the more immediate topic of my article, and which the comments of approval from engineers

qualified to speak with authority on such questions lead me to believe was readily understood.

There is a widespread belief, even among engineers, that a long stroke results in a lower final pressure on the expansion curve of the indicator card, i.e., that the expansive force of the working medium is more completely utilized. I am inclined to believe that it is this erroneous assumption which induced the contributor of the above statement to claim higher efficiency for the long stroke engine.

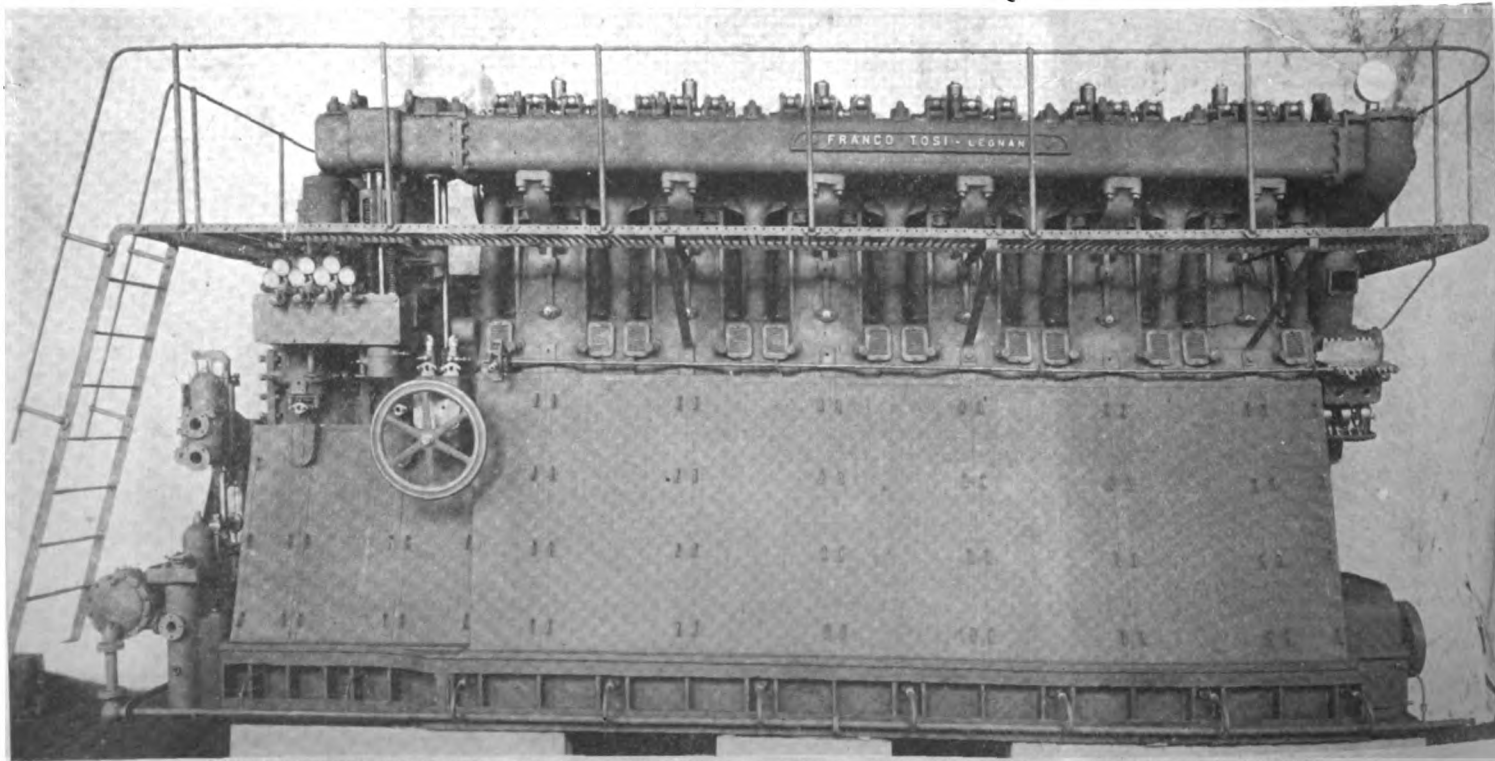
By means of the thermodynamic relations underlying the operation of internal combustion engines, it can be easily proven that where the displacement volume in the engine cylinder is constant throughout the complete cycle of operation, the final expansion pressure for a certain load depends solely upon the ratio of compression. In other words, since the mechanical stroke in any practical engine of today is of course invariable, its length has no effect upon the final pressure; what is more, since in their particular class (2-cycle, 4-cycle, high-speed, low-speed) all Diesel engines have practically the same ratio of compression, their final expansion pressure is so nearly alike that their efficiency could not possibly show any measurable difference on that score.

I am advisedly using the term mechanical stroke in contra-distinction to what may be termed physical stroke, the latter meaning that portion of the piston over which the cylinder becomes filled with

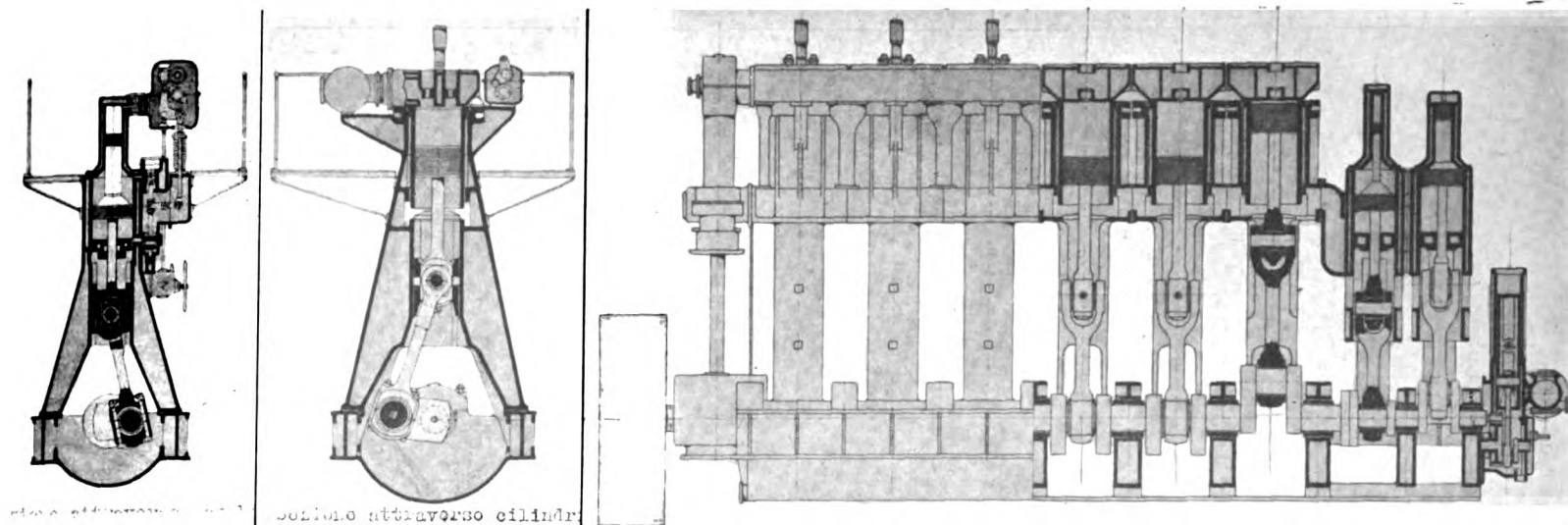
air of atmospheric pressure. Examination of any indicator card shows that this physical stroke is always less than the mechanical stroke, and it is to the extent to which the former is shorter than the latter that the above statement regarding final expansion pressure will have to be somewhat modified: shortening of the physical stroke, all other conditions remaining the same, lowers the final pressure. From this it would appear that shortening the physical stroke offers a means to increase the efficiency, an assumption which indeed only a few years ago was proclaimed with much persistency to be the basic principle of the ideal gas engine.

A short physical stroke is prima facie evidence of low volumetric efficiency (although not a means of measuring same!). It also means, on account of the reduced weight of air taken into the engine cylinder, a lower compression-pressure and therefore lower economy and lower output per cubic-inch piston displacement.

Low volumetric efficiency is exactly one of the reasons why long stroke engines, of a stroke to bore ratio such as that of the cited European engines, are not customary today. For a given piston speed the volumetric efficiency will be the higher, the larger the effective valve port areas: there is, however, a practical limit in the convenient placing of valves, if the latter are not to require pockets extending far beyond the contour of the cylinder bore, which would endanger the life of the cylinder head. It can be readily under-



The six-cylinder 600 b.h.p. Tosi four-cycle, direct-reversible Diesel-type merchant marine heavy-oil engine



Sections and general arrangement of the Tosi 600 b.h.p. merchant ship Diesel-engine

stood, therefore, that a long stroke engine, with a comparatively small bore, does not permit the placing of valves of most suitable size.

The two engines referred to as typically European, in my opinion, therefore are by no means representative of the most accepted marine-engine practice. To anyone acquainted with present European practice the figures given at once disclose the particular type of engine the writer refers to, for this is the only four-cycle marine engine today that has such an unusual stroke to bore ratio.

Unfortunately, I do not, at this writing, have access to such data applying to this particular engine with which to exemplify my statement as regards low volumetric efficiency. I have, however, recently read a statement applying to this same engine to the effect that its compression pressure is only 410 lbs. per square inch; by implication this would verify my claim for a low volumetric efficiency on this engine, for a compression from atmospheric pressure to only 410 lbs. could hardly be considered high enough on which to safely start a marine Diesel engine under all conditions. If my critic will be kind enough to present data showing the exact valve proportions, as well as one or two light spring indicator cards (photographically reproduced and enlarged) of this engine, I shall be glad to go into a more extensive technical discussion of this very important subject.

In the meantime, all I can state is that extremely long stroke marine engines, for the reasons suggested above, as well as other reasons referred to in my earlier article, are neither popular today nor are they likely to become so in the future. The claim for their superior economy is a fallacy which could only be supported with some show of reasonableness by the somewhat reduced wall surface through which heat is abstracted during the period of most intense heat development; whatever gain results from this score, however, is far more than counter-balanced by the losses referred to, as well as by structural disadvantages.

Among the latter, for the particular European engine held up as an example, I consider the lack of rigidity the most serious one. Without wishing to reflect upon the success of this type of engine, which in some installations at least has made quite a creditable showing, I am personally convinced that a number of irregularities that have occurred in their operation were caused by lack of rigidity, and that the same is almost directly traceable to, or at least augmented by, their unusually long stroke. It must be remembered that a long stroke engine is materially increased in height in relation to its cylinder bore, and that a high engine, with a valve gear arrangement as in this particular one, and mounted on a more or less yielding foundation, is bound to be subjected to considerable vibrations. It is undoubtedly due to these factors that for the four-cycle, type a stroke, to bore ratio of from 1.50 to 1.55 has been adopted practically universally on all modern merchant marine engines.

In this connection I am in position to call attention to a type of marine engine which, although new to American engineers, has for some time been in use in the Italian navy where it has fulfilled all the requirements incidental to their heavy war service. This particular type of engine is the product of the Tosi works at Legnano, Italy, and embodies their accumulated Diesel engine experience covering a period of over 10 years.

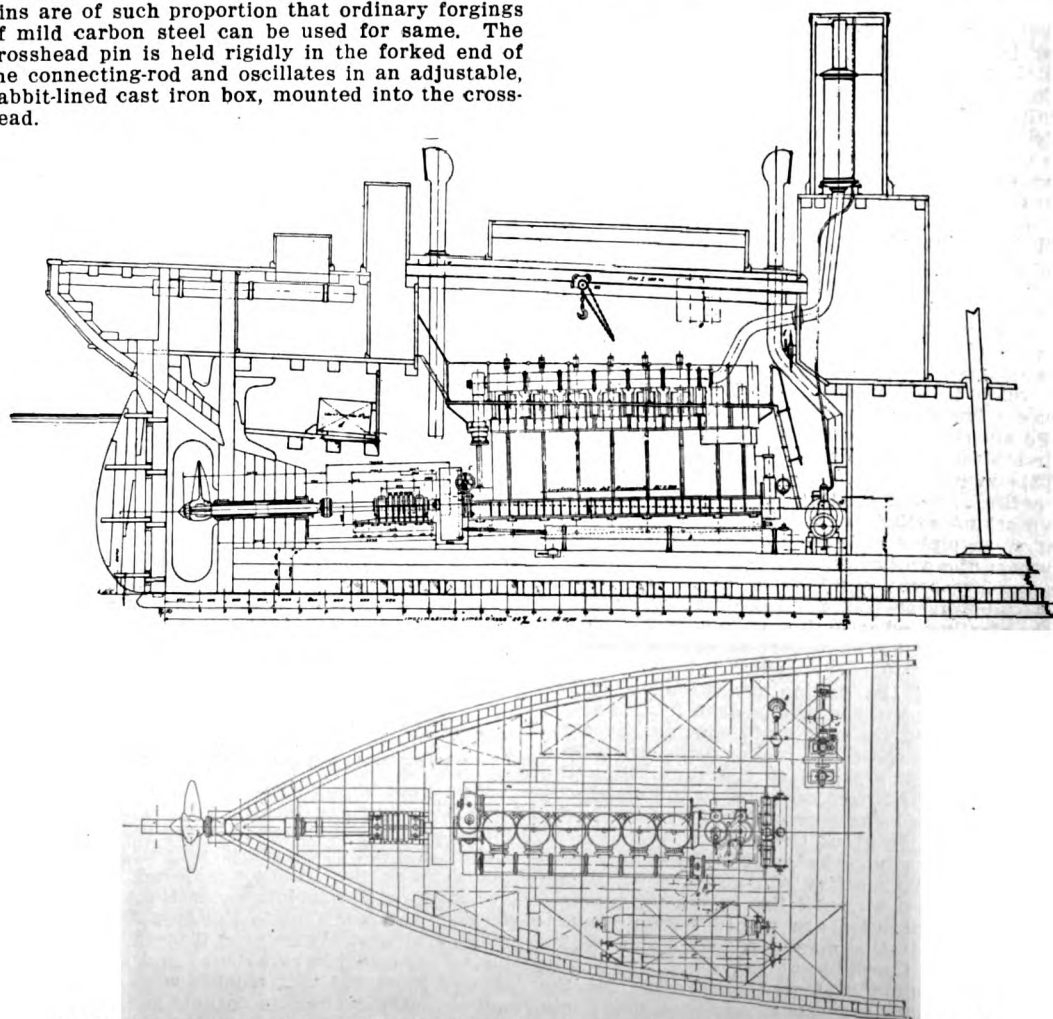
The drawings show in somewhat fragmentary sectional views the general features of this engine, which is built in this form in capacities up to 900 B.H.P.; it will be noticed that it is of the four-

cycle crosshead type. Piston and rotative speeds are chosen in accordance with the most accepted practice for reliable and economical operation. The ratio of the stroke to cylinder bore has been determined with the view towards minimum engine height and at the same time keeping the maximum loads within such limits as are desirable for engines of this nature; this ratio, in the 6-cylinder 600 H.P. size, is 1.55.

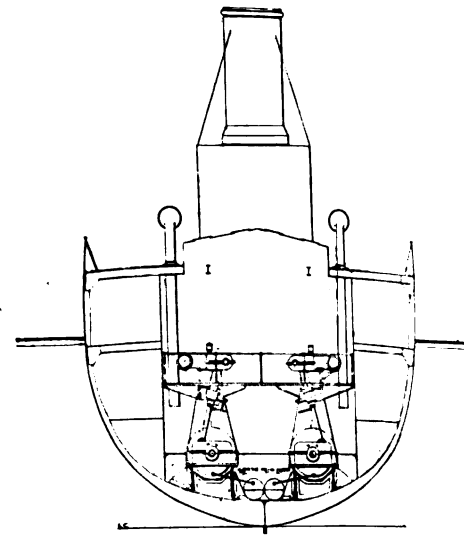
The frame is of the "A" type and comprises in one piece the cylinder jacket wall, as well as the crosshead guide. It is made of ordinary gray iron and of such cross section as to ensure maximum rigidity against side pressure. A separate cylinder, made in the form of a plain tubular casting of a special close grained iron, is inserted into this frame in such a way that when held in position it is free to contract and expand longitudinally. The same method of intensive water circulation around the cylinder-liner is used which has given such good results on their submarine engines (see "Motorship," March, 1918).

The crosshead guide is bored out at the same setting with the cylinder; it is of ample surface to ensure minimum wear. The crosshead shoes are also made of cast-iron and are adjustable so as to take up wear. Crossheads and shoes can, with the connecting-rod, be removed bodily through the cylinder.

The connecting-rod, piston-rod, and crosshead pins are of such proportion that ordinary forgings of mild carbon steel can be used for same. The crosshead pin is held rigidly in the forked end of the connecting-rod and oscillates in an adjustable, babbitt-lined cast iron box, mounted into the cross-head.



Machinery arrangement of a 600 b.h.p. Tosi-Diesel engine wooden motor-ship built in Italy



## THE SUN DIESEL ENGINE

**AUXILIARY MOTORSHIP, "FANESTRAND"**

## MOTORSHIPS AND THE COAL PROBLEM

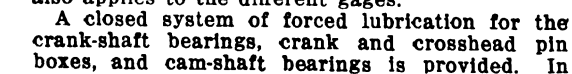
As Sir Marcus Samuel (a British oil king) practically suggests on another page of this issue, the wasteful use of valuable oil under boilers of steamships no longer can be tolerated, even if his own and other oil companies lose, if only motorships are built from now onward. Obviously, no one in the United States should lay down another coal or oil-burning steam freighter or tanker of under 15,000 tons, but should proceed as rapidly as possible with the building of oil-engined motorships.

**CORRECTION**

**CORRECTION**  
On page 7, column 3 of our August issue it was stated that orders had been placed for 62 Diesel engines of 750 b.h.p. each by the U. S. Emergency Fleet Corporation. This, of course, was a typographical error and should have read 72 engines.

## NEW MOTOR TRAWLERS

**NEW MOTOR TRAWLERS**  
 It is reported that Fairbanks-Morse 200 h.p. oil-motors are to be installed in three trawlers to be built by Connors Bros. Ltd. Black Harbor N-B-.



Finally there is an installation of one 6-cylinder engine on a full-power single-screw wooden boat, of which also a number have been built. The solid construction of the engine foundation is worthy of particular notice on these boats, and undoubtedly accounts a good deal for their satisfactory service. [The Tosi works have under construction at the present time an engine of somewhat different design for large units of which a description will be given in an early issue of this Journal.—Editor.]

## NON-ESSENTIAL ENGINEERING AND STEEL

Apropos our editorial leader in the August issue entitled, "Steel—Non-Essential Engineering, and Ships," we note with interest that within two weeks of its publication the War Industries Board advised pleasure automobile manufacturers that no further supplies of steel will be allowed them until they convert their plants to 100 % war work.

## SHIPOWNERS AND AUXILIARY SHIPS

Appropos the various articles on the motor-auxiliary ship question in this issue, we may remark without comment that one very experienced Norwegian shipowner ordered a large wooden-auxiliary on the Pacific coast and lost over \$50,000.00 after it was in service through unsatisfactory operations. Yet in the face of this financial loss he afterwards ordered three additional auxiliaries because his experience and common sense clearly indicated that trouble with one ship need not necessarily effect the others and that the auxiliary is a good type of merchant ship.

# Kahlenburg Marine Heavy-Oil Engine

## A Well-built Motor of the Surface-Ignition Class

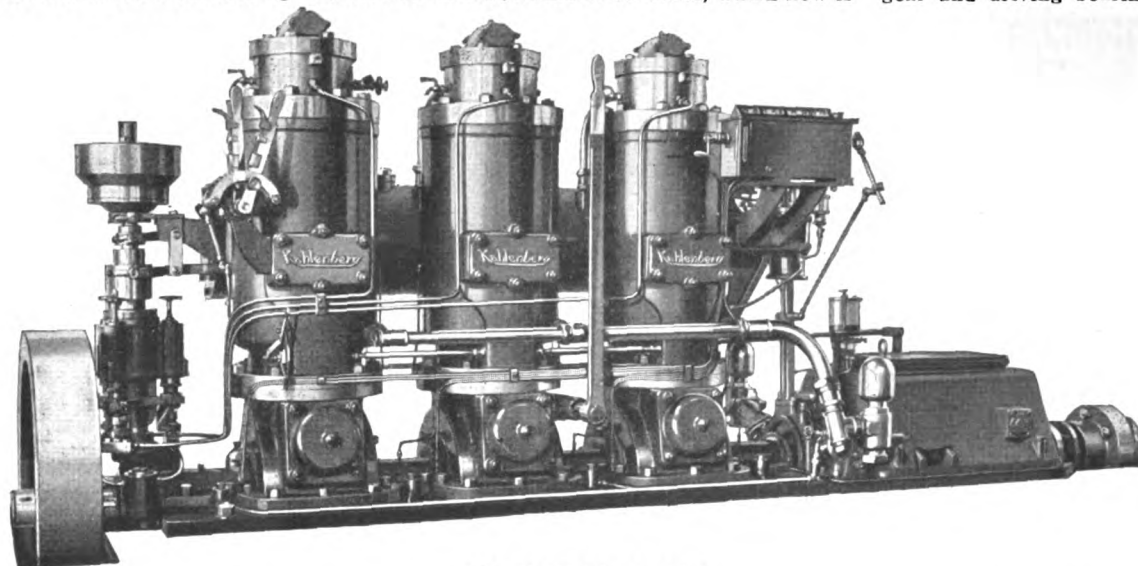
WHEN on a trip round the middle-west engine and marine-accessory works several months ago, we made a visit to the marine heavy-oil engine plant of Kahlenburg Bros., Two Rivers, Wis., and came away with most favorable impressions, which still remain. For the class of engineering which we saw, especially the workmanship, was far above the average usually seen in motor works of similar size.

The marine oil-engine which they build is of the surface-ignition class, operating on the two-cycle single-acting system, with enclosed crank-case and with crank-case compression for scavenging. There are many features in the design of the Kahlenburg engine which causes it to rank among

bearing journals for examination or replacement at any time, and the length of time required to do this should not take over 30 minutes. Likewise this refers to the center or intermediate bearings. The reader readily will see that should it ever happen that he would have to remove a bearing like this for replacement while at sea, it easily could be done. It would not be necessary to disassemble any part of the machine to take these journal bearings out, with the exception of removing four cap-screws, which hold the journal caps in position. This type of engine has a water-cooled crank journal, i. e., same are so built that there will be a continual flow of water around the lower half of the journal at all times, which flow is

gines will always run as if they are missing when the load changes. But in this case the engine will have no excessive vibration, because the governor simultaneously acts on all three pumps.

The circulation of water around the crank journal is another feature, especially for long runs, but it in no way interferes with easy removal of either the end or intermediate crank-bearings without disassembling any part of the machine, excepting the journal caps. All balance wheels are flanged to the hub on the crankshaft. This, as may readily be surmised, allows the removal of the balance wheel without drawing the keys. The latter, in the course of time, "freeze" to the shaft. The reverse gear and driving bearing are all incorporated on



The 90-100 b.h.p. model

the leading marine motors of this class and power.

As yet large sizes have not been built, and for the purpose of description we will take the three-cylinder 90-100 b.h.p. model which develops the powers quoted at 300 and 340 respectively on a weight of approximately 10,000 lbs. (5 tons), and with a fuel-consumption of 0.58 lb. of heavy-oil per brake-horse-power per hour.

By spacing the cylinders a little wider apart than is the custom with many engines of this type, it has been possible to arrange the main bearings outside of the crankcase, where they readily may be overhauled and felt by the ship's engineers. Furthermore, the crank-journals are so constructed that the operation can remove the inner b.c.n.e

regulated by a little valve attached to a pipe from the sea valve. This engine does not require any fresh water-injection in the cylinders.

Not an unimportant feature of the design is that the engine will run idle or slow without putting on the "torches." This on account of the patented construction of cylinder head. When operating under any condition the governor acts directly on each fuel-pump and shortens and lengthens the stroke of each pump one after the other. Therefore, the machine will run with equal regularity at any and all speeds. Those who are acquainted with other designs of engines, you know that there are some that cut out the fuel-pump entirely when the speed is at a given point. Therefore such en-

the engine base, with a view to insuring perfect alignment at all times.

Generally speaking, the engine is intended strictly for heavy-duty service and so is of sturdy construction, no attempt having been made to cut weight, yet there is no surplus of material where unnecessary. Lubrication is effected by the Madison-Kipp force-feed oiler, which was fully described in the August issue of "Motorship." At the forward end of the engine is a neat self-contained vertical governor and fuel-pump set. This governor acts directly upon the fuel-pumps and thus controls the quantity of fuel injected into the combustion chamber. In action the governor is simple, but sensitive, which allows of delicate control.

## The U. S. War Department Builds Concrete and Wooden Motorships

### Twenty-two Vessels Already Ordered

(Passed for Publication)

SOME time ago "Motorship" indicated that the U. S. War Department intended ordering a number of motor-driven vessels, and suggested that engine-builders should get into communication with the Water Transport Branch of the Embarkation Service, 310 Mills Building, Washington, D. C. We now are able to announce that no fewer than twenty-two (22) concrete and wooden small motorships already have been ordered and that further orders may soon be placed. During our various visits to Washington we have found that this division of the War Department firmly believe in the value and importance of the many advantages of the marine internal-combustion-engine for the propulsion of ships, and will utilize the same when possible in every suitable ship, including in some large transports of 7,500 tons-gross that shortly will be ordered in conjunction with the U. S. Emergency Fleet Corporation. Incidentally we feel we may mention that we found many keen readers of "Motorship" among the officials responsible for the designing and purchasing of these motorvessels, they finding many of the technical articles that we have published most useful to them in their work.

Among the motorships that definitely have been ordered are seven 130 ft. reinforced-concrete freight and passenger vessels for river service, and these are being built by the West Coast Shipbuilding Company, of Everett, Washington. Five of these craft will be propelled by twin 300 b.h.p. Standard heavy-duty four-cycle-type ma-



"Petrel," a Fairbanks-Morse oil-engined cannery tender described in our last issue

rine motors of the electric-ignition class, using distillate as fuel. These engines are being constructed by the Standard Gas Engine Company of San Francisco, Cal. The other two ships will have twin 300 b.h.p. Union distillate engines, to be built by the Union Gas Engine Company of Oakland, Cal.

There also are five 100 ft. reinforced-concrete water-tank boats to be built by the Gt. Northern Shipbuilding Company of Portland, Oregon. In each of these vessel twin 125 b.h.p. Frisco Standard motors most likely will be installed.

So far these are the only large motor passenger and freight vessels to be ordered by the War Department, but there is a possibility that additional motors will be installed in other vessels from time to time.

Finally there are ten 64 ft. wooden-built motor tugs that have been ordered. Five of these tugs are to be built by the Crisfield Shipbuilding Company of Crisfield, Maryland, and five by the Richardson Boat Company of Tonawanda, New York. All ten tugs will be powered with model W-5 Winton gasoline engines. The War Department is very much interested in heavy-oil-engines, and in the near future we can look forward to some Diesel-engined vessels being ordered including the big transports referred to. An official recently inspected some marine Diesel engines at the Winton Engine Works and was very favorably impressed with this design of motor.

# Novel Large British "Diesel"-Driven Tanker

The "Santa Margharita," a Motorship of About 11,000 Tons d.w.c., Fitted with Solid-Injection Vickers Oil Engines of 2,500 b.h.p. and with Auxiliary Motors of 1,150 b.h.p.

**W**HETHER the largest British motorship is in actual service or not, we have no knowledge; but, last spring the first of two ledge; but, last spring the first of two marine Diesel engines ran its tests at the Glasgow oil-engine works of Harland & Wolff. If she is not yet in service, we presume she soon will run her trials. However, during the war Great Britain has maintained almost a foolish secrecy in connection with motorships that have been built in her yards. We say "foolish secrecy" because these vessels are ordinary oil-engined merchant ships and no similar secrecy has been adopted in connection with the new British standardized steamers. Among British merchant motorships built during the war, over which reticence previously has been maintained, is the "Santa Margharita." She is a two-decked steel ship of about 11,000 tons d.w.c., built to Lloyds highest class by Vickers Ltd. of Barrow, England, to the order of Sir Thos. Royden of the Cunard Steamship Company of Liverpool. She is of very considerable interest as she has high-powered oil engines of the solid-injection type, also her Diesel electric auxiliary machinery is unusually interesting.

Her general dimensions are as follows:

Length .....	440.0'
Breadth .....	54.3'
Moulded Depth .....	36.4'
Displacement (Presumably) .....	14,000 tons
Dead-Weight Capacity (about) .....	11,000 "
Gross Tonnage .....	7,499 "
Under Deck Tonnage .....	6,784 "
Net Tonnage .....	4,864 "
No. of "Diesel" Engines .....	2
No. of Cylinders per Engine .....	8
Bore and Stroke .....	20.7" x 33"
Total Designed Horse-Power .....	2,500 Shaft H.P.
Maximum Horse-Power .....	2,800 "
Revolutions .....	130 per minute
Average Speed of Ship (loaded) .....	11 knots

She is built mainly to carry oil, but as she is classed as a two-decked ship, we presume she is one of these vessels that were converted, while building, to tankers. She now has a capacity for over 8,000 tons of oil-cargo, in addition to 900 tons of bunker oil, besides which there is hold space for some 2000 tons of general cargo, thus enabling the vessel to earn money on the outward run. The machinery is installed right aft, as is usual on most tankers, and a peculiarity to be noticed from the outside of the ship is that the funnel is very small and seems altogether out of proportion to the size of the vessel. It is, of course, sufficient for its purpose, but from the aesthetic standpoint it would have been much better either to have had a full-sized funnel or else to have discharged the exhaust gases up through small pipes alongside the masts, as has been done in so many previous motor ships.

As just mentioned, the "Santa Margharita" was built by Vickers Ltd., of Barrow, and the machinery installed constitutes the highest-powered sets yet built by this firm for mercantile work. There are two engines, each designed for an output of 1250 b.h.p. at 140 r.p.m., having eight cylinders with diameters of 20.7 ins. and a piston stroke of 33 ins. Actually, these engines develop a good deal more than this power, probably 1400 b.h.p. being nearer the total at full speed. At sea a speed of rotation of 130 to 135 r.p.m. is maintained continuously, and the vessel makes an average of 11 knots when loaded.

The "Diesel" engines are of the usual Vickers solid-injection (or mechanical-pulverizer) type, and it is interesting to have confirmation that practically no trouble has been experienced with this system, which, therefore, appears to be well

adapted for slow running and heavy jobs, although it was the opinion in some quarters that such would not be the case. When it is remembered that the pressure employed in the system reaches the neighborhood of 4,000 lbs. per square inch, it will be realized that there are possibilities of trouble unless every detail is properly worked out; but, apart from leakages here and there, which have been overcome, no fault can be found with the operation of the engines of the "Santa Margharita." The fuel pumps, of which there are two for each engine, are made tremendously strong and are machined out of the solid, the whole of the system being tested to the enormous pressure of 6,000 lbs. per square inch. A drawing of this system was published on page 21 of the July issue of "Motorship."

The engine, with its eight cylinders, is built up on the usual Vickers entablature system, the entablature being supported by strong stanchions. The cylinder jackets are separate and are bolted to the entablature, while the cylinder covers, which are of cast steel, hold the separate liners in position. The employment of steel for the covers is, of course, very unusual with motors of the four-cycle class, where it is not customary to find a source of weakness in the covers. It might, in fact, seem to be somewhat unwarranted, and an unnecessary expense, but there are reasons for taking more precautions than in ordinary four-stroke machines. It has led to successful running so far as this detail is concerned, for there has only been one occasion of a cracked cylinder cover and this was due to the circulating sea water inlet becoming choked with mud when the ship was in shallow water passing over a sandbank or bar. The cylinder cover cooling space became nearly full of soft sand, and it is not surprising that a crack resulted.

Following a custom which is now becoming more and more common with Diesel engines, forced lubrication is adopted throughout the motor, and the crankcase is enclosed by means of light doors, and in these are small sliding inspection covers, by means of which the bearings can be inspected. The result is a very clean engine room with little splashing of oil. It should be mentioned that the supply of lubricating oil is maintained by an independent pump of the rotary type which keeps a pressure of a few pounds per square inch on all the bearings. There is one of these electrically-driven pumps for each engine, but as it is on the level of the engine-room floor, there is an occasional loss of pressure, and it would probably have been preferable to have plunger pumps which, we believe, are now adopted on new Burmeister and Wain ships.

For the lubrication of the cylinder walls, however, the general system is not adopted, and, instead, the Madison-Kipp type of lubricator is used. In the engines under description it has given the very greatest satisfaction.

The pistons are cooled by sea water, the system employed being the use of dipping pipes attached to the body of the piston, the pipes being external to the piston rods, although the latter are hollow. It is with this water cooling that the only real trouble with the main engines has been experienced, the difficulties being due to leakage in the glands, a fault that has been found in certain other Diesel motors. The effect was to cause deterioration of the lubricating oil, with which the sea water mixes, and also splashing of the water on to the cylinder walls, thereby leading to sticking of the piston rings and to "blowbacks" past the

pistons. These faults meant the escape of a gaseous mixture into the engine-room, which caused a fire to break out at the electric generators; and since, as will be seen later, the ship is wholly dependent upon electrical supply, the effect from this simple cause was serious.

The trouble has now been overcome by fitting a better type of gland, and with this there is fair confidence that, at any rate so far as the main engines of the "Santa Margharita" are concerned, break-downs are at an end. It may be remarked that although leakage at glands seems to be a simple matter and an easily-remediable problem, it is not a question of water pouring out and dropping down into the crank sump. It is far more subtle than that, and often the water cannot be seen, but there is, nevertheless, a sufficiently fine spray to be splashed upon to the piston and cylinder and cause the whole trouble.

The arrangements for actuating the valves in this engine and for reversing do not follow quite ordinary lines. There is the usual camshaft running the length of the motor, driven off the crankshaft by gearing and a long vertical spindle with further gearing at the top. The levers for opening and closing the exhaust and air admission valves swing on another horizontal shaft, somewhat above the camshaft and nearer to the cylinders. This "fulcrum" shaft, as it may be termed, is turned through half a revolution when it is desired to set the levers for astern running, this being effected owing to the eccentric mounting of the levers on the shaft. The exhaust and inlet valves are thus provided for, but the change in the fuel-valve setting is effected by having an astern and an ahead cam on the camshaft immediately adjacent to each other, and moving them along to suit the condition of running.

The whole of this reversing motion is, of course, operated from the starting platform of the engine-room by a small air motor, which performs both operations at once, the control being through a small hand lever, whilst, in the event of a break-down of the mechanical gear, the same movement can be carried out by a large hand wheel. The speed of the motor is controlled by a small hand wheel which regulates the amount of fuel admitted. When the engine is started up, first all the cylinders run on compressed air, then two on fuel and six on air, next four on each, then six on fuel and two on air, and finally all on fuel. This operation is carried out by a hand wheel suitably marked so that the engineer can see how the gear is set. The air pressure for starting is a maximum of 600 lbs. per square inch, but the engine will start at a much lower pressure, sometimes only 120 lbs. per square inch being needed. Generally speaking, the Vickers solid-injection engine is of the Diesel principle, except that the method of fuel injection differs.

The auxiliary machinery of this ship is of the very greatest interest, since everything, without exception, is operated by electricity, which, although common in many existing cargo motor-vessels, is unique in a large tanker where such large pumps are required for the discharge of the oil. Both on the port and starboard side of the main engines is an electric-generator parallel to the propelling machines and each is driven by a four-stroke Vickers six-cylinder "Diesel" motor developing 300 b.h.p. at 380 r.p.m. having cylinders 13 ins. bore with a piston stroke of 18 ins. These engines are also of the solid-injection type, but are relatively complicated sets, and, as they have to run continuously, they have from time to time



Launch of a 4,000 b.h.p. submarine at the Fore River plant of the Bethlehem Steel Company. This submarine is the largest yet built in the U. S. A., being 278' long and 1,500-ton submerged displacement. She is being equipped with four Niseco-Diesel four-cycle type heavy-oil engines, each of 1,000 b.h.p. A speed of 20 knots is expected.

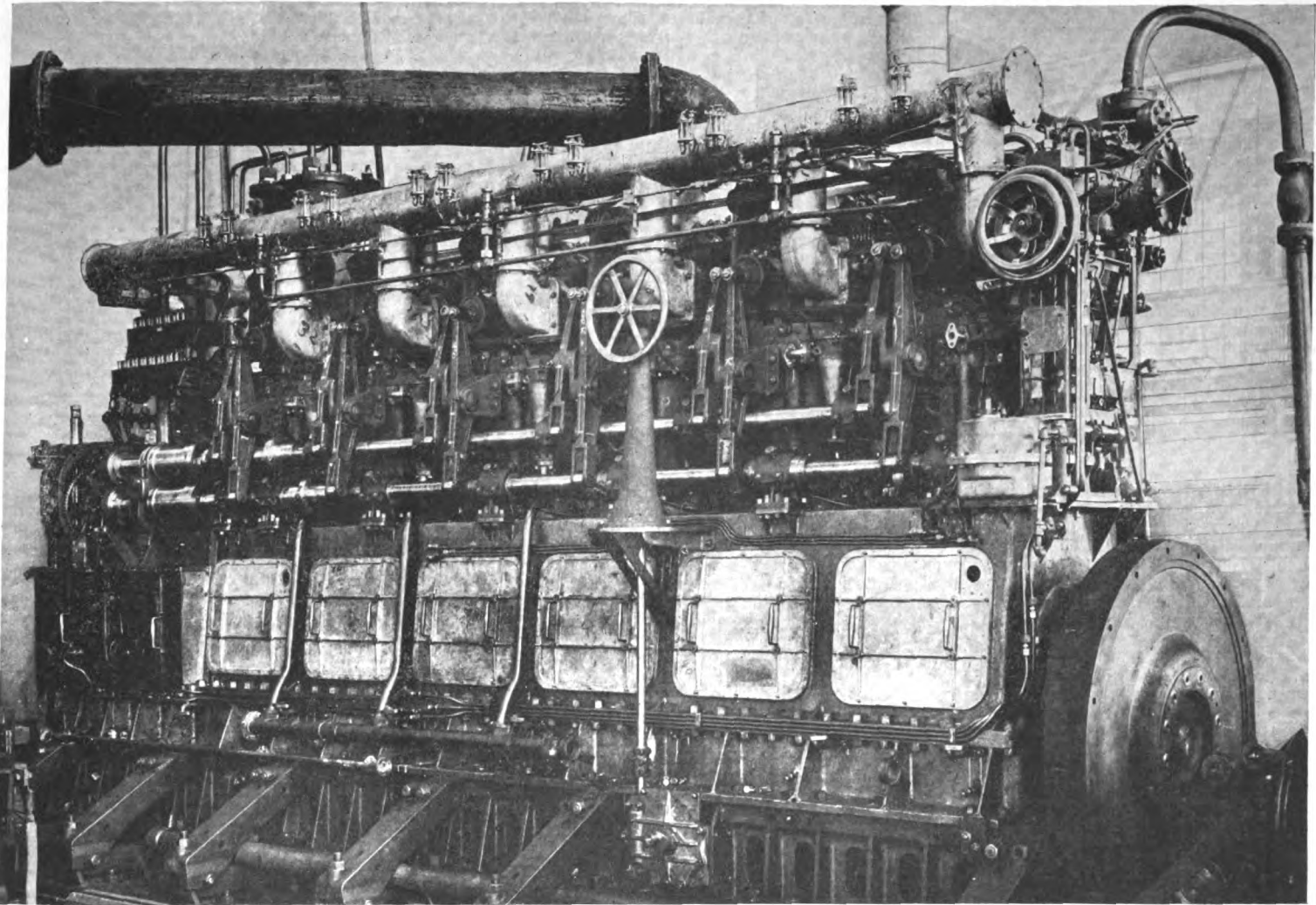
been a source of trouble, just as disastrous, so far as the ship is concerned, as if the main engines broke down. Their work has, however, now been eased by the installation of a 150 b.h.p. Petter surface ignition oil-engine driving a dynamo, this motor being capable of taking all the load when the ship is at sea, so that the "Diesel" driven generators are only needed when the large pumps or winches are working in port. The voltage of the generators is 220, and they have a maximum capacity of about 1200 amperes each.

In the engine-room forward of the main engines

and situated athwartships are two "Diesel"-driven air-compressors with an air pressure of 600 lbs. per square inch. The "Diesel" engines are of the same type as motors developing 200 b.h.p. each. They are only required when manoeuvring the main engines, and can be shut down as soon as the ship is well out of harbor and the air bottles pumped up to 600 lbs. per square inch. So the total auxiliary power installed amounts to 1,150 b.h.p., or the highest on any motorship yet built.

There are two large pumps for discharging oil, the electric motors driving them being in the

engine-room at the forward end, whilst the pumps are on the other side of the bulkhead, the drive being through gearing. Each pump is capable of pumping 500 tons per hour, the ordinary capacity being 400 tons. The other electrical plant includes all the winches and capstan, as well as the steering gear, which is of the variable-speed-gear type, and has given the very best results that could have been expected. All the engine-room pumps (bilge, sanitary, etc.) are also driven by electric motors. Finally we will point out that none of the engines of this ship are of the true Diesel cycle.



The 1,000 b.h.p. six-cylinder, four-cycle, direct-reversible, naval type Niseco marine Diesel engine, built by the New London Ship & Engine Co. of Groton, Conn. This is the first illustration of this new model to be published. It operates at 375 R.P.M.

## The Australian Motorship "Cethana"

### Further Details of this American-Built Diesel-Engined Merchant Vessel

IN the August issue of "Motorship" an article was given dealing with the new wooden motorship "Cethana," built on the Pacific Coast for the Australian Government, and equipped with twin Diesel engines constructed by McIntosh & Seymour, of Auburn, New York. We now are enabled to give some additional details of the acceptance trials of this most interesting vessel, and some further data concerning her dimensions and tonnage. We also repeat some of her dimensions. She is of the single well-deck type and is classed to Lloyds 12-A.1.

#### THE HULL

Length (Overall)	280' 0"
Length (B. P.)	265' 0"
Official Length (B. P.)	262' 6"
Molded Breadth	46' 0"
Molded Depth	24' 0"
Depth of Hold	22' 0"
Draught (Light)	6' 6" forward, 15' 2" aft
Displacement (Loaded)	22' 0" Amidship
Dead-Weight Carrying Capacity	2300 tons
Under Deck Carrying Capacity	1874 "
Gross Tonnage	2341 "
Net Tonnage	1788 "
Fuel Capacity	60,060 gals. (1500 lbs.)
Water Tankage	6500 gals.
Dia. of Each Propeller (Cast Iron)	8' 0"
Pitch of Each Propeller	6' 4"
Projected Area of Each Propeller	14.2 sq. ft.
Developed Area of Each Propeller	15.8 sq. ft.
Dia. of Tailshaft	8.75"
Length of Engine-Room Space	38' 8"
Material of Hull	Douglas Fir
Average Speed of Ship on Trial	10.45 Knots

#### THE MACHINERY

Propelling Engines	Twin-Screw (500 B.H.P. each engine.)
Type	Internal-Combustion Fuel-Oil Diesel-Engines, 4-cycle, single-acting, direct-reversible, trunk-piston, enclosed crank case.

Size	625 Indicated (500 Brake) H.P. at 185 R.P.M.
Cylinders	Number of... 6 (each engine) 16" bore x 24" stroke.
Built by	McIntosh & Seymour Corporation, at Auburn, New York, under license from the Atlas-Polar-Diesel Motors Company of Stockholm, Sweden.
Weight per Engine	146,000 lbs. (73 tons) complete with thrust-bearing and air-compressor.
Length (Overall)	29' 6"
Width (Overall)	6' 5"
Height (Overall)	12' 11"
	(16' 0" clearance necessary for removal of pistons.)
Dia. of Flywheel	5' 0"
Dia. of Crank Shaft	9 1/2"
Dia. of Crank Pins	9 1/4" x 9 1/2" long
Thrust Bearings	Steam-Engine type, collar-thrust, separate bed-plate casting bolted and keyed to engine-bed.
Average Revolutions on Trials	183 R.P.M.
Average B.H.P. Starboard Engine	404.4 H.P.
Average B.H.P. Port Engine	438.5 H.P.
Mechanical Efficiency	78%
Air-Injection Pressure	950 lbs.
Average I.M.E.P. (Starboard)	18-11 lbs.
Average I.M.E.P. (Port)	96-29 lbs.
Starting and Maneuvering Air Pressure (About)	300 lbs.

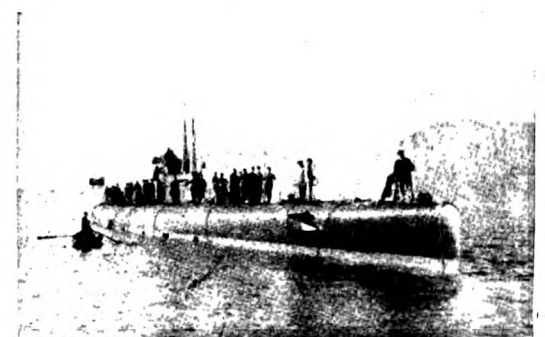
On the trial Calor fuel-oil of the following composition was used, but the exhaust was clear at all times, showing complete combustion.

Baume' Gravity	23 deg.
Specific Gravity	.91 deg.
Asphaltum Percentage	25%
B.T.U. per pound	19000
Weight per gallon	7.58 lbs.
Water, Sulphur, etc.	0.01 lb.

The average temperature of the engine-cooling water was 118 degs. Fahr. As regards lubricating-oil consumption, this was eight gallons per engine per 24 hours, or 6 barrels per month. The fuel

consumption averaged 0.420 lbs. per shaft H.P. hour. How this consumption was figured we do not know; but presume that it was estimated on the assumption that the engines each were developing on average of 500 b.h.p. or else 25 per cent was deducted from the average indicated horse power and the brake horse power consumption figured from the resultant figures. As a general rule the latter is the more accurate method of working out the fuel consumption after the engines are installed, and probably this method was used in this particular case.

It is most interesting to note that with a fuel-capacity of 1310 barrels of oil, the "Cethana" has a cruising radius of 41 days and nights at an average speed of 10.35 knots.



A large Diesel-engined Lauroti-type submarine built by the Ansaldo-San Giorgio, Ltd., of Spezia, Italy

# Defects in the Heavy-Oil Engine Working on the Otto Cycle

By J. C. SHAW

**T**HERE are several inherent weaknesses in the Otto cycle heavy-oil engine advocated in a recent paper read by Dr. Lucke before the Engineers' Club of Philadelphia and published in "Motorship." These defects, which are pretty well-known from experience and which makes it questionable if such an engine will ever be considered seriously in the marine field, are briefly as follows:

1. Too small margin in automatic ignition.
2. Works on the explosion principle.
3. Poor starting and maneuvering qualities.
4. Liable to smoke and foul up.

In the Otto cycle engine, as advocated and actually accomplished in a way by several experimenters, the margin for automatic ignition is small and easily disturbed. This is because dependence is made on other sources of heat than that due to compression alone, as in the Diesel. It is, accordingly, difficult to predict beforehand how such an engine, if modified in size or slightest detail, will function. At reduced powers and speeds various devices are usually resorted to as throttling the inlet air, causing re-entry of exhaust gases, or choking the cooling water. These devices are unsatisfactory, complicate control, and invite heat troubles. If solid-injection is used, with cam-operated pump, the atomization, in addition,

is apt to be defective at reduced speeds and powers.

It is quite possible to have the efficiency of the Otto cycle engine, under ideal conditions, equal to that of the Diesel, with half the compression of the latter, as was stated in the paper referred to, and as can be shown by comparing the theoretical formulae for efficiencies of the two. However, no mention was made of the fact that the maximum pressure in such a case for the Otto cycle engine would probably greatly exceed that of the Diesel, and furthermore, that this pressure would be applied suddenly at dead center in the form of an explosion. In the Diesel, on the other hand, the compression, which is usually from 455 to 485 lbs., is followed by a very slight rise of pressure, if any, when slow combustion starts and extends over a considerable part of the working stroke. It is due to this lack of shock and resulting smoother action that the higher compression engine is particularly adapted to the large powers per cylinder required in the marine field.

In starting up cold with the low-compression engine some provision for warming up has to be provided for, or some auxiliary ignition system installed. A similar adverse condition has to be provided for when maneuvering is to be done, or

the functioning of the engine becomes uncertain. In the Diesel this does not exist, as it has sufficient margin in automatic ignition, due to compression alone, to meet all starting and maneuvering conditions. The Diesel also has better slow speed torque, seen from the form of its indicator card, which, with the absence of knock, makes toward greater flexibility. The knock or pound at dead center, characteristic of the explosion engine, is aggravated when starting up or running slow.

With the Otto cycle engine, the combustion is liable to be incomplete, as previously stated. This is shown at the exhaust by black smoke, due to improper burning of fuel striking after being mixed with the air, or by blue smoke caused by fuel striking heated surfaces. Such a condition tends to foul the combustion space, and is very objectionable in a marine installation where complete burning of the fuel is desirable at all times to obtain that continuous uninterrupted service demanded at sea.

In view of the natural shortcomings of the heavy-oil engine working on the Otto cycle, as here pointed out, it is difficult to see where it has much future, especially in the marine field, in competition with the present highly developed Diesel-type constant-pressure engine.

## News and Notes from All Countries

### MR. BERNHARD MILLS' ARTICLE

Appropos the interesting article recently contributed to "Motorship" by Mr. Bernhard Mills, Superintendent-Engineer of the American Hawaiian Steamship Company, our British contemporary "Syren & Shipping Illustrated" comments very favorably upon Mr. Mills' remarks and appears to agree fully with him.

### ITALIAN OIL-ENGINED GUNBOATS

On the Piave river the Italians are using oil-engined gunboats and motor-barges in their gallant drive against the Austrians. They also have some Diesel-driven vessels of special type for carrying observation balloons. For obvious reasons it would be dangerous to use steam-driven craft for the latter duty. We give an illustration of an Italian concrete motor-barge mounted with a large gun.

### OUR COVER ILLUSTRATION

The excellent photograph of sailing ships on the cover of this issue of "Motorship" is by Webster & Stevens, the commercial photographers of Seattle, Wash.

### TWELVE LAUNCHES FOR U. S. QUARTERMASTER'S DEPARTMENT

There are now building at the yard of the Luders Marine Construction Company, Stamford, Conn., twelve 61-foot launches for the U. S. Quartermaster's Department in which will be installed Frisco-Standard distillate motors of 65 b.h.p. each.

### NEW NORWEGIAN DIESEL MOTORSHIPS

There are on order for Norwegian shipowners no fewer than seven Werkspoor-Diesel-driven steel motorships totaling 38,450 tons dwt and of

19,050 i.h.p. in addition to one small vessel of 450 i.h.p. which will have a non-reversing Werkspoor-Diesel engine and a reversible propeller, similar to the tanker "Poseidon" that recently was taken over by the U. S. Shipping Board and described in "Motorship" a year ago. Four of the above motorships are of 6,500 tons dwt; one of 6,600 tons dwt, and one of 3,000 tons dwt, and one of 2,850 tons dwt. Five will be twin-screw vessels and the others single screw. The engines are being built in Holland and the ships in Norway.

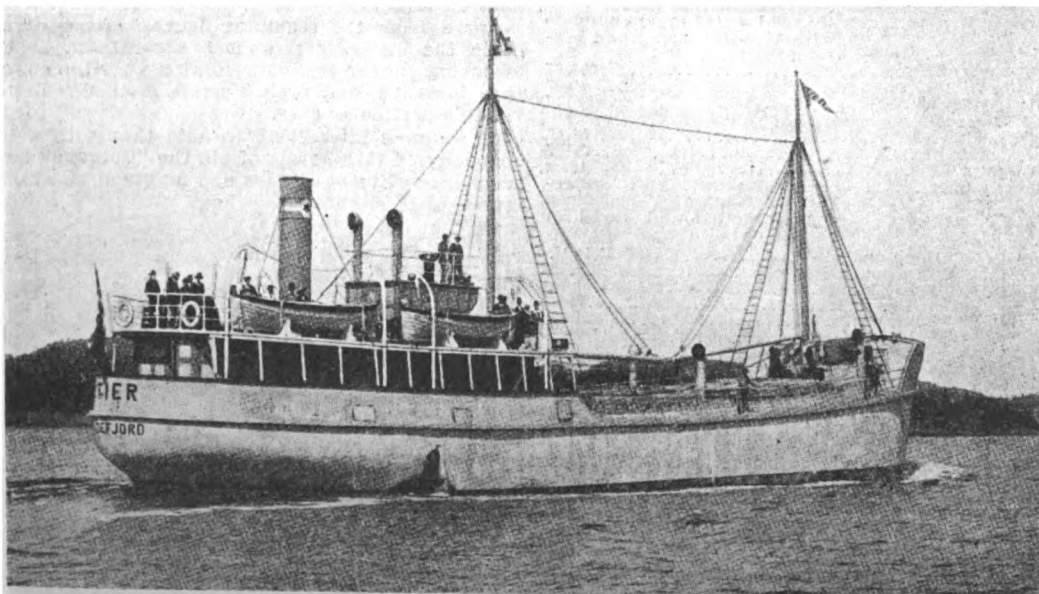
### TWO MOTORSHIPS FOR PACIFIC STEAMSHIP COMPANY

The accompanying illustrations are of the motor auxiliaries, "Admiral Sims" and the "Admiral Mayo," the eleventh and twelfth, respectively, of such vessels built by the Puget Sound Bridge & Dredging Company of Seattle, Wash., and the first two motorships to be owned and operated by the Pacific Steamship Company. They are sister ships, each being 267 feet long, 44 feet wide, and have a moulded depth of 22 feet. Their deadweight capacity is 2,500 tons, and are each powered with two four-cylinder 360 b.h.p. Skandia oil engines. They are rated as four-masted topsail schooners and have been given the highest rating of Bureau Veritas.

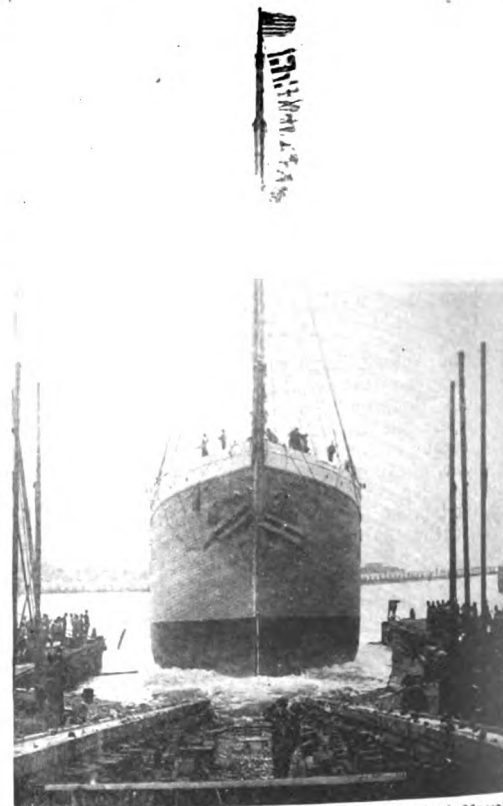
Both of these vessels were built to builders' account, but in a deal transacted some time ago they were taken over by the Pacific Steamship Company, the operators of the Admiral line of steamships; hence the name "Admiral," as applied to the vessels. The "Admiral Sims" was launched the early part of June, and the "Admiral Mayo" on July 6th. The installation of the main engines

of these vessels is soon to be completed, and they will be given their trials about July 30th. Both vessels will, in all probability, be used in the transpacific trade of the owners; but no doubt will also be called into the Alaska routes at the height of the southbound canned salmon movement in the fall.

Unusual importance is attached to these vessels because of the fact that their propelling machinery consists of the first sets of the new 360 b.h.p. size Skandia surface-ignition type oil engine, built by the Skandia Pacific Oil Engine Company at Oakland, Cal., a description of which will appear in an early issue.



Another view of the concrete motorship "Stier." She was built to the order of Mr. Lief Bryde, of Standefjord, Norway, and was described in our last issue.



Launch of the oil-engined auxiliary "Admiral Mayo" at Seattle. She is of 2,500 tons d.w.c. and is fitted with two 360 b.h.p. Skandia oil-engines. A sister ship is illustrated elsewhere in this issue.

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Photo S. I. M. French Ministry of Marine

France has many Diesel-engined submarine patrol-boats and convoying ships. The Diesel engines adopted by the French Navy are the Schneider; Normand; Sulzer; Sabathé; and Loire. The above illustration depicts a French submarine-chaser of special type. Note the absence of smoke.

#### EAGLE CLASS OF SUBMARINE DESTROYERS

According to Frank Parker Stockbridge in the New York "Times" the Eagle class of submarine-destroyers now being built by Henry Ford, are 204' long and will draw 8' when fully equipped and ready for sea. The propelling power of each is a steam-turbine of 3000 h.p. with reduction-gear to the propeller-shaft, which turns a three-bladed propeller of steep pitch. Crude-oil fuel sufficient for about 3000 sea miles at cruising speed, will be carried. Except for a high deck-house and a bridge just forward of amidships, the deck is unbroken and flush. By the time this appears in print a dozen of these vessels will be afloat and the remaining 188 craft are expected to be ready by this time next year. Obviously the

had the same been used for constructing one large 23-knot motor-driven submarine-destroyer, or else two 750-ton, 25-knot, submarine-destroyers? Surely they could be built cheaper, quicker, and would require less labor and a reduced quantity of material? Of course, such a change probably would have meant a special act of Congress, because the Naval appropriation called for fleet-submarines—not submarine-destroyers.

#### AUSTRO-GERMAN SUBMARINE

For the illustration on page 11 of the June issue of "Motorship" we were indebted to the courtesy of Jane's "Fighting Ships," a review of which appears elsewhere in this issue.

#### CENSORSHIP DE LUXE

We learn from an unofficial English source that the British Censors have issued an order forbidding full descriptions of German submarines being published. What's the great idea? Furnishing the Huns with valuable engineering information we presume! If such information were published it would be useful to American engineers and submarine builders but we fail to see how it can assist Germany.

#### A BIG INDUSTRY

There now are on our private records no fewer than 107 manufacturers of marine heavy-oil engines of the surface-ignition class, showing how important this industry has become.

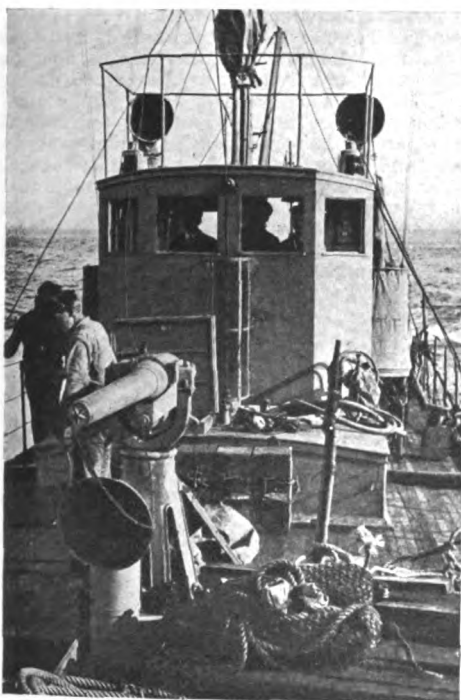


Photo S. I. M. French Ministry of Marine

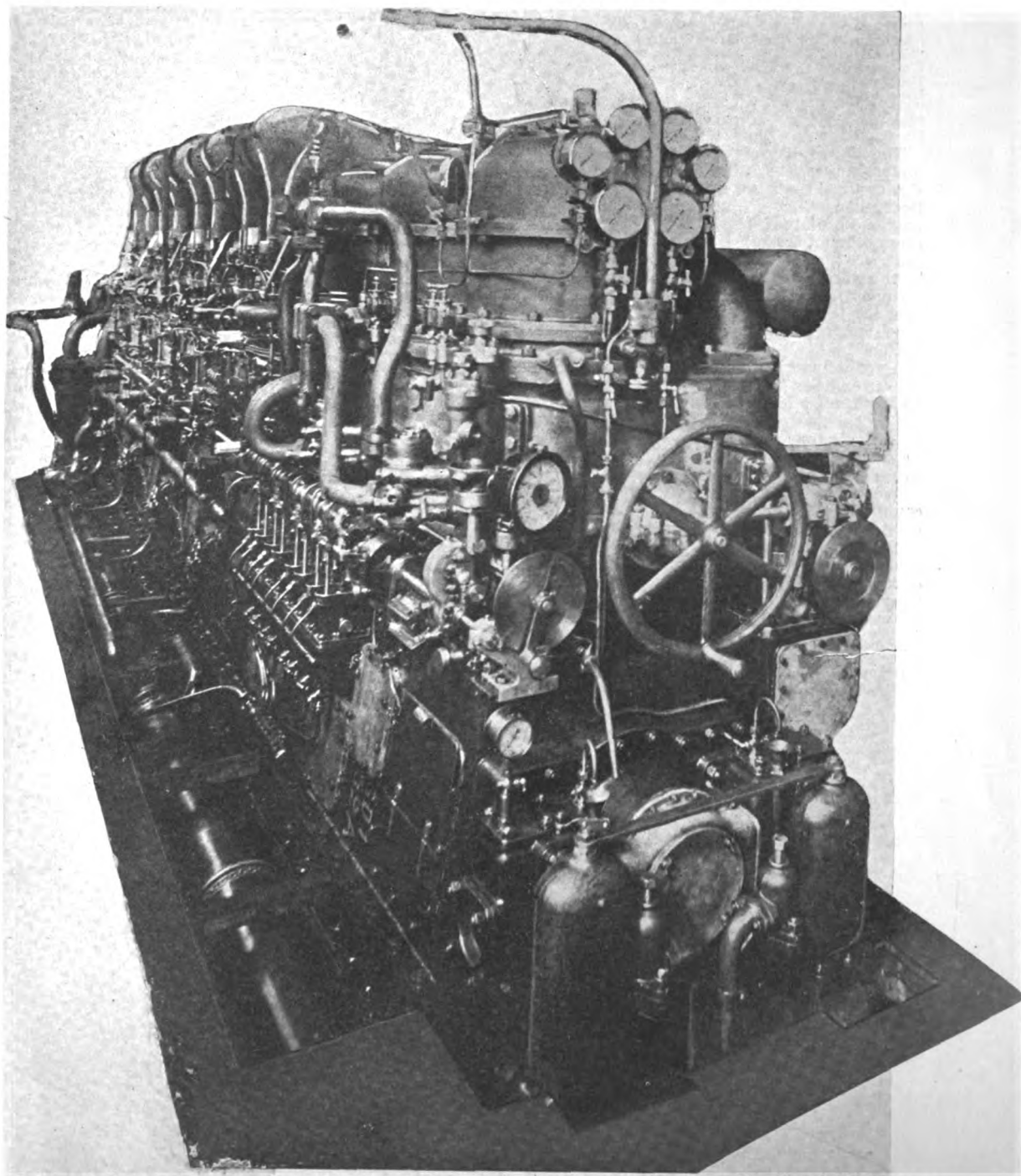
The deck of an American-built Standard-engined 110-ft. patrol motorboat belonging to the French Navy.

Ford automobile will not be popular in Germany after the war!

As we previously indicated, the efficiency of these craft would be very greatly increased had internal-combustion motors of the heavy-oil type been adopted and we hope they will be used in many of these destroyers. If 3000 h.p. is the power installed, then two submarine type oil-engines of 1500 h.p. each probably could be adopted. The following engines could have been used: Sulzer, Tosi, Ansaldo-San Giorgio, Ansaldo, Schneider, Vickers, and Price. All but one of these engines have actually been successfully used in service in the power required. With a triple-screw boat the 1000 h.p. Niseco-Diesel engine also could have been used. The three Niseco engines then could be "staggered," the same as in the submarine-destroyer illustrated on page 8 of our June issue. This would avoid increasing the beam of the ships.

#### SUBMARINES OR SUBMARINE-DESTROYERS?

On another issue of this page is given an illustration of a new 4,000 h.p. submarine. While this craft undoubtedly will be very useful in operations against Hun U-boats, also if the German Fleet manage to break out, one might be inclined to ask if the steel used in the construction of her hull and Diesel propelling oil-engines, would not have been of far greater value at this stage of the war



An eight-cylinder two-cycle type, direct-reversible, 1500 b.h.p. Schneider naval marine Diesel engine as installed in French and Japanese submarines. Two are fitted per boat.

# Motorship Building in the Netherlands

ALTHOUGH Holland had to rely entirely upon other countries last year for the major part of her shipbuilding materials, she managed to make considerable progress with motorship construction, particularly with small cargo vessels, many larger Diesel-engined vessels being held back by inability to obtain crankshaft forgings, etc. The outcome of the material shortage is that a large syndicate of prominent engineers and shipbuilders has been formed for the purpose of erecting a \$12,000,000.00 blast-furnace plant, and it is said that one of the foremost men in connection with this enterprise is Mr. J. Muysken, Managing-Director of Werkspoor, and other strong financial backing has been obtained. Already several American engineering concerns have expressed their intentions of bidding for the work of erecting the new plant. This will be a severe blow to German after-war trade, because previous to the war the Germans supplied the majority of engineering materials to Holland, the German Government subsidizing all exported steel forgings, etc.

According to the Dutch official shipbuilding returns fewer than seventy-two steel motorships aggregating 20,423 tons gross (300 tons gross average per ship) were launched during 1917. This means about 35,000 tons d.w.c. aggregate. Some were Diesel-driven, others were fitted with surface-ignition type of oil motors, such as the Kromhout, Brons, Bolnes and Staandard.

At the Werkspoor Works, Amsterdam, many large marine four-cycle type Diesel engines are on order, including for the following ships:

Name of Ship	Owner
"Tydeman"	Ind. Mil. Marine,
"Salerno"	Otto Thoresen
"San Miguel"	Otto Thoresen
Un-named	Otto Thoresen
Un-named	Otto Thoresen
Un-named	Otto Thoresen
"Athene"	Ada Steamship Co., Salversen
"Escadente"	Cia Valencia de Vapores,
Un-named	Det Norske Handelselskip

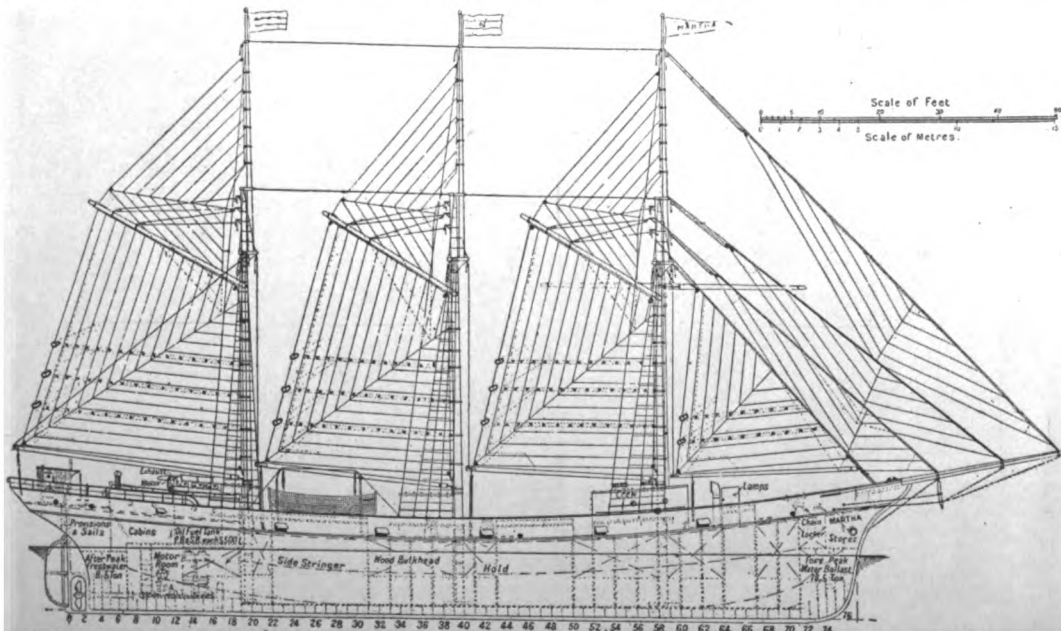
The above list of vessels make a total of 33 motorships aggregating 36,800 b.h.p. (45,000 I.H.P.), engined or being engined by Werkspoor since December 1908. The highest-powered Diesel engine is that of 1400 b.h.p. (1950 I.H.P. at 110 r.p.m.) being installed in one of Mr. Otto Thoresen's freighters. For the auxiliaries of the ships in the above list the same builders have on hand sixteen Diesel engines aggregating 1,800 BHP, as the auxiliary machinery will be of the electric type, the generators for which will be Diesel-driven.

A report reaches us that other large Werkspoor Diesel engines have been ordered by Norwegians, as mentioned elsewhere in this issue.

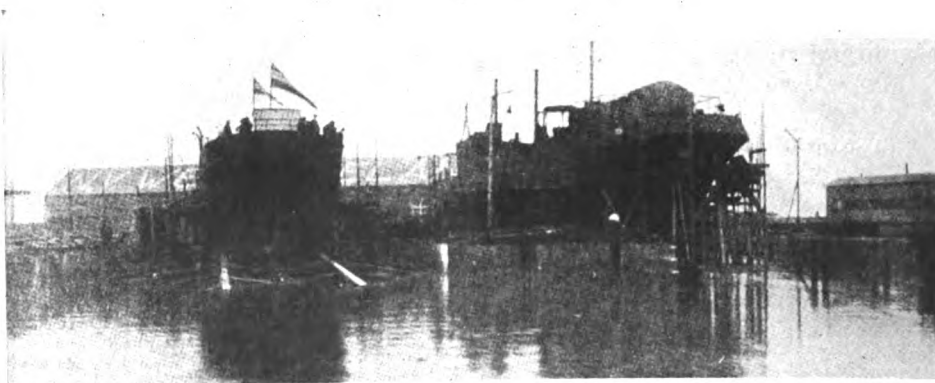
Several motor tug-boats have recently been built, including the "Gerina Johanna," built at the Farmsum shipyard, Delfzyl, in which a 105 b.h.p. Brons oil-engine is installed.

Among other interesting motorships recently completed in Holland is the 500-tons, three-masted steel schooner "Martha," one of the series of sister auxiliary motorships now under construction for the Vrachtraat My Neerlandia of Rotterdam by the Zeeland Shipbuilding Co., Ltd., Hansweert. Her dimensions are as follows:

Length, Overall	155'	6"
Length, B. P.	136'	0"
Breadth, moulded	25'	6"
Depth, moulded	12'	3"
Draught, extreme	11'	3"
Deadweight capacity	550 tons	



Profile arrangement of the Dutch motor-auxiliary schooner "Martha"



Steel-built motor auxiliary sailing vessels under construction in Holland

In the case of this vessel the power is only intended for use during periods of calm weather, or when "bucking a headwind" or strong tide. This machinery consists of a two-cylinder 15 1/4" by 17 1/4" Kromhout surface-ignition heavy-oil engine of the two-cycle type that develops 120 b.h.p. at 240 r.p.m., and which gives the "Martha" a loaded speed of 6 knots without sails. The fuel consumption of the main engine is said to be 0.49

tons d.w.c., of which four are 1,000 b.h.p. Diesel driven. The latter are now completing in the U. S. A. and McIntosh & Seymour oil-engines are being installed. It also is expected that a number of motor-auxiliary sailing-ships will be built.

## GERMAN VIEWS ON MOTOR TUGS

Writing in "Hansa," H. Gerstmeier points out that motor-tugs are little used for large vessels and barges in port service, although they are used to an ever increasing extent in canal work. Under the general economic conditions prevailing at present, it is considered that there is a good case for the use of crude-oil motors in harbour tugs; coal supplies are difficult to obtain and operation on oil saves space, weight, and fuel costs. In addition a motor is always ready for immediate service, and it is possible to use much better ship lines, thus reducing the bow wave and effecting further operating economies; for the same reason, a motor-tug is to be recommended for running through ice. The writer suggests that every encouragement be offered to shipyards to develop the best combination of motor and hull for tug service.

lb. per b.h.p., which is very good for this class of motor. The builders of the Kromhout engine are D. Goedkoop, Jr., & Co., of Amsterdam. This ship was constructed under special survey to the Bureau Veritas.

Altogether the total tonnage of steam, motor and sailing vessels launched in Holland during 1917 was 192,318 gross tons, so the motor-driven vessels represented quite a good percentage, and as all the motorships listed above would have been completed had materials been available, the proportion would have been much greater, as it would have meant nearly 50,000 additional tons of motor vessels. Indications show that once normal conditions are renewed Holland will rank important in the world's field of motorship builders. There has been no real shortage of labor in Holland since the war, the main difficulty being the securing of material to keep the men fully occupied, and to obtain food to feed them.

## AUSTRALIA'S NEW MERCHANT MARINE

There will be added to Australia's present fleet of steam and Diesel-driven merchant ships, 35 to 40 new vessels during the next one or two years. Fourteen of these will be wooden craft of 3,200



The Fairbanks-Morse engined Alaskan cannery tender described in the August "Motorship"

## OIL-ENGINED AUXILIARIES

On another page are detailed remarkable voyages of a number of oil-engined motor auxiliary sailing-ships. With one exception—the Fairbanks-Morse engined "City of Orange"—the vessels in question are equipped with Bolinder surface-ignition motors.

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**"MOTORSHIP"**

# Oil-Engine Sprayers or Pulverizers

## No. 3

(Continued from the July issue)

By A. H. GOLDINGHAM and C. T. O'BRIEN

IN the last installment of this article we referred to four distinct types of sprayers, two of which only, namely the Lietzenmeyer or "open" type and the "Deutz" sprayer (designed for use of two fuels, one of very heavy characteristics and the other of lighter gravity) were described and illustrated. One of two remaining types of sprayers mentioned, one of these the "Hesselman" was first employed in the Polar Swedish Diesel engine. A similar design is now

lbs. per sq. in. is admitted through the passage "A" and enters the chamber "B." The fuel valve D which is held on its seat at the lower extremity by the force of the spring coil J placed between flanges I and K is opened at the proper period for injection (see Fig. 4) by the positive action of a lever acting against the collar threaded and locked on to the upper part of the valve stem and shown at H. This lever is actuated by a rapidly moving cam attached to the camshaft.

When the valve is lifted from its seat and opens, the highly compressed air rushes through the ports E, passes along down to the expanding passage around the valve stem at M and then to the combustion space.

As the valve D opens the pressure in the expanding passage N to M around the valve is naturally reduced and consequently the constant pressure of the air in chamber B pressing down on the fuel has a tendency to force the oil upwards through the passage R towards N until the level of the fuel reaches the lower end of the passage R. The blast of compressed air passing through the various passages E thoroughly atomizes the fuel incoming at N and it is thus carried down along the expanding passage shown at M and passes through the radial passages to the burner plate or nozzle marked F. By this means the very fine spray of fuel and air is thoroughly atomized and evenly distributed into the combustion space against a compression pressure of 500 to 600 lbs. per sq. in. It should be noted that the valve D is made to fit fairly accurately at the upper part of the atomizer but considerable clearance is allowed at the lower end shown at M.

The Sabathé method of fuel injection is the fourth of the special types referred to. This design is shown in section at Fig. 21. The feature peculiar to this type is the injection of the fuel in

pressure. When this injection system is in operation at higher loads, the second phase of fuel injection is reduced and the combustion at constant pressure is lessened or eliminated entirely with very light loads and then the engine works practically as a constant volume explosion design of engine. This type is constructed with two fuel inlet valves, one of which is of the ordinary design and is opened first, allowing a slight amount of fuel and compressed air to enter the combustion space. Then later the valve stem is raised further, which brings the pins projecting from the valve stem in contact with the upper valve (shown

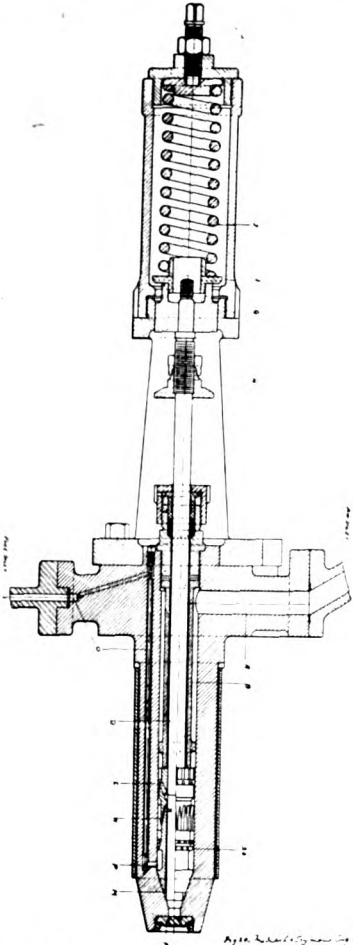


Fig. 20. McIntosh & Seymour sprayer

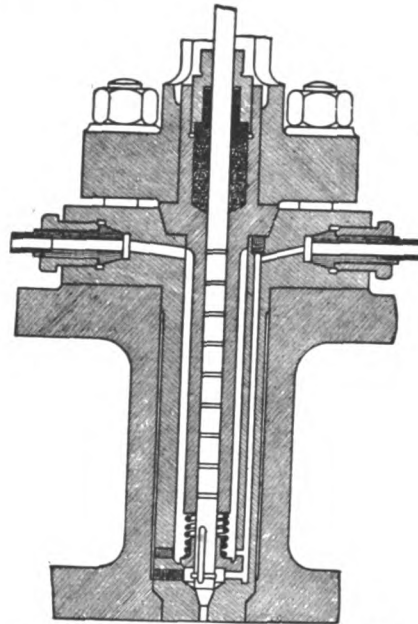


Fig. 21. Sabathé fuel injection valve

two distinct phases. The first injection of fuel takes place when the piston is at or near the upper dead center and combustion is then produced at constant volume, the pressure in the cylinder instantly increasing. The second fuel injection takes place later, producing combustion at constant

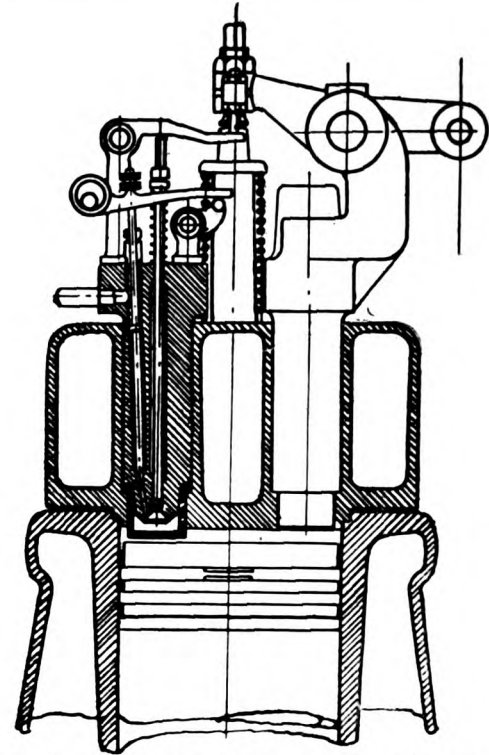


Fig. 25. Cylinder and spray-valve Burnoil engine

in Fig. 21) which is a loose fit on the valve stem and held in place by the spiral spring placed above it, as indicated in the illustration. The valve motion is arranged so that the lift of the valve stem is varied with varying loads, the lower valve only being allowed to open at lighter loads. Besides economy in fuel consumption considerable economy of compressed air is claimed for this system which is applied so largely to marine propulsion and when working at reduced rotative speed the period of injection of valve opening is greater than at normal speed.

The Diesel type spray valve of the De La Vergne Machine Co., is shown in Fig. 22. It is of the closed type, the valve seating inwardly. Like the Snow-Diesel design of spray valve shown in Fig. 14 (see July issue) it is constructed for a horizontal engine and is of great length. The body A of this spray valve, see Fig. 22, is made of cold rolled steel with a cast iron flange H shrunk on it. The nozzle E is of cast iron and forms an oil tight seat with the valve body by means of the copper ring U. The two side pins are inserted so as to withdraw the nozzle with the valve body when entirely removing the apparatus. The gasket G placed on the shoulder of the nozzle forms a gas

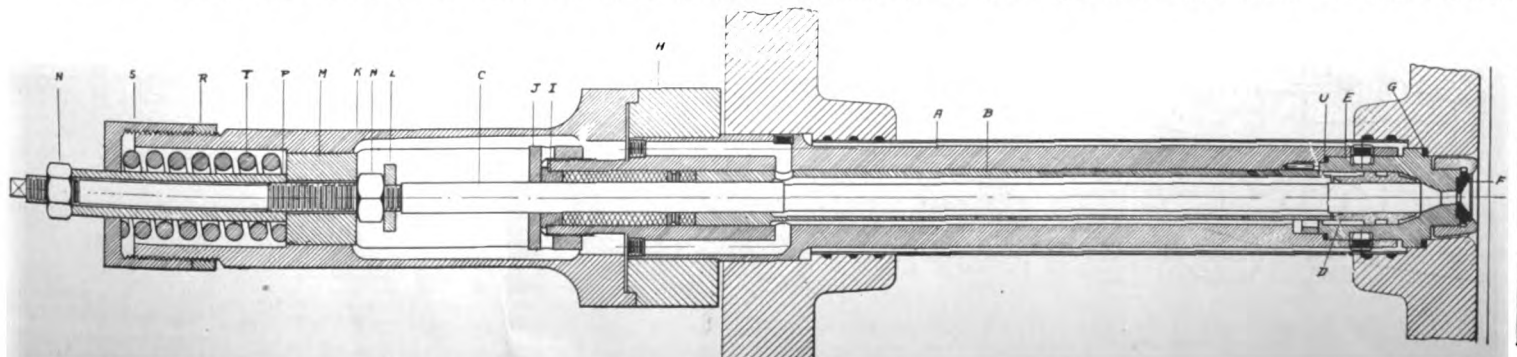


Fig. 22. De La Vergne Diesel spray valve

manufactured in the United States by the McIntosh Seymour Corporation at Auburn, N. Y., and is shown in Fig. 20. It is placed in the center of the cylinder-head between the air-inlet and exhaust-valves of this firm's well-known vertical type marine and stationary Diesel engine. The piston has a concave-shaped head and consequently the fuel injected into the combustion space (with the piston at the inner dead center) has a shape with its greatest volume in the center. Referring to Fig. 20, it will be noted that the fuel from the oil supply pump enters the passages O, and is delivered to the annular space at the lower end marked P. The amount of fuel which, of course, is varied in accordance with the load is sufficient at heavier loads to reach the level above the ends of the ports marked R. The slotted passages at the periphery of the atomizing flanges shown at "SS" allow the fuel to be evenly distributed around them. Compressed air at a pressure of 800 to 900

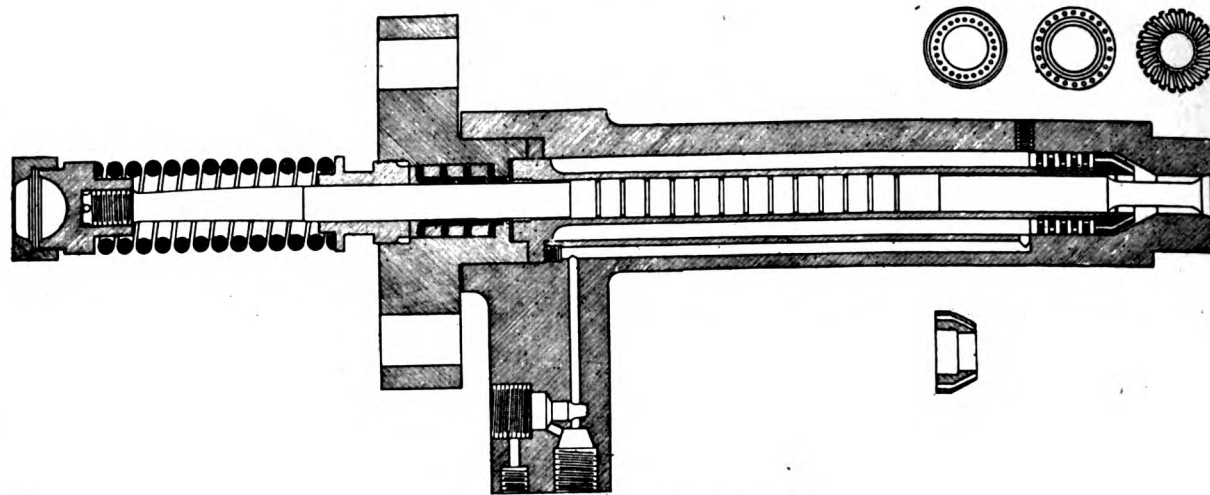


Fig. 23. Burmeister &amp; Wain Injector

tight seat in the cylinder head. The spring holder K is of cast iron centering on the spray valve body flange. The bronze sleeve B acts as a central guiding support for the spray valve and also prevents the air and oil from mixing until they reach the atomizer at the lower end. Compressed air enters as shown, and passes along the air passage until it reaches the spray valve stem. It fills the space between the sleeve and stem and then mixes with the oil before entering the atomizer "D." The fuel enters the oil passage as indicated and passes between the sleeve and the body. A flat surface being made, the full length of the sleeve as illustrated in the sectional drawing. The oil and air are thoroughly mixed as they pass through the fine grooves of the atomizer. The nozzle F, made of steel, is held in place by the nozzle cap.

The sleeve "B" rests on the nozzle at the lower end and is retained in place by the packing which is fitted tightly into the stuffing box by the pressure of the gland and nut, J & I. The length of the stuffing box in this design is a notable feature and is appreciated by the operator of the engine.

The steel valve stem C is hardened where it rests in the guide of the atomizer. The spring I which is of considerable length allows very quiet operation, is held in place by the large cap, and locked nut S & R and the plunger M. Its force is transmitted to the valve stem through the sleeve P and the lock nuts N. The valve stem end is made square which allows manipulation by a wrench if necessary so as to remove dirt from the seat without removing the whole valve.

This spray valve is an interesting example of the latest design of Diesel sprayers. Arrangement, it will be noted, is provided for inserting tap bolts into the flange so that if carbonized when in position, it can be easily forced out by simply tightening these bolts against the cylinder head.

A fuel inlet or pulverizer of special design and which deserves special comment, is that shown at Fig. 23 and made by the well known firm of Burmeister & Wain, Copenhagen, Denmark. Reference has been made in the previous article to the great importance of thoroughly combining the particles of the fuel inlet spray with the air in the combustion space and exposing the greatest amount possible of the surface of the globules of fuel spray to the oxygen in the air and it is accomplished largely in this type as follows: The fuel inlet valve here opens downwards instead of being lifted from its seat in the usual method.

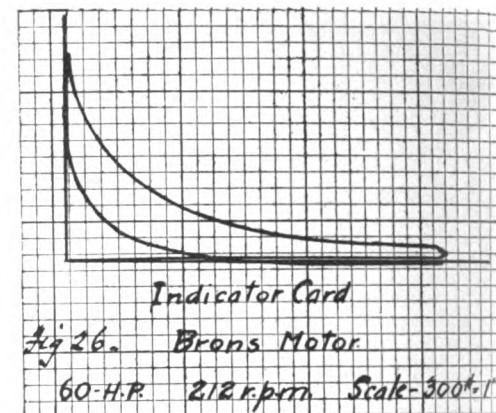
The spray of fuel as it enters the combustion space strikes against the coned head of the valve (see Fig. 23) and is thus thoroughly and evenly

distributed around the whole of the combustion space and thus very excellent combustion is obtained and the heat developed is also evenly distributed over the whole of the piston surface. Fuel consumption in a marine engine of this construction in actual service of 0.421 lbs. per shaft of actual horsepower per hour has been recorded. The design of this sprayer otherwise is very similar to others illustrated, but it will be noted that above the coned valve is placed a cone with spiral shaped flutings which gives to the fuel spray a rotary or swirling motion which assists in the thorough distribution of the fuel as already described.

The Hvid-Brons, or Burnoil Engine Co.'s system of fuel inlet valves and ignition is shown at Fig. 24 and 25. This system differs from the true Diesel cycle as here the ignition is caused by the heat developed during the process of compression of the air in the cylinder together with the additional heat caused by the air passing through minute holes drilled through the sides of the cup marked A in Fig. 24. Operating on the 4 cycle plan the compression in the cylinder of this engine is carried to about 450 lbs. per sq. in. The mode of operation of the fuel inlet device is as follows: The fuel tank is placed above and the oil gravitates to the engine, after passing the oil inlet valve it enters the passage in which is placed the needle valve H (Fig. 24), which is controlled, in operation, by the governor; thus the amount of fuel passing this valve varies with the load on the engine. The fuel afterwards passes to the seat of the valve B. This valve is opened during the air inlet period of the cycle and allows the fuel to be deposited in the cup below it, marked A, which extends into the combustion space as shown in Fig. 24.

During the upward or compression stroke of the piston, the compressed air in the cylinder becomes heated and this air is forced through the small holes in the cup shown at CC causing part of the fuel to vaporize and ignite, resulting in first a small or light explosion in the cup itself, thereby the remainder of the fuel is expelled from the cup into the cylinder combustion space and is completely ignited. An indicator diagram taken from a Brons Engine of this description built in Holland is shown in Fig. 26. This card shows results of a 60 HP. single-cylinder engine operating at 212 R.P.M. The pressures are indicated by the scale shown on the diagram.

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#### LAKE TORPEDO BOAT CO. EXTEND WORKS

The submarine-building yard of the Lake Torpedo Boat Company is being extended, and it is expected that 5,000 men will eventually be employed. At present there are about 2,000 hands.

#### DIESEL ENGINE USERS' ASSOCIATION

Diesel-engine owners and operators in America are privileged to join the Diesel Engine Users' Association (of Gt. Britain); but a full membership of the association is confined to chief engineers of installations of Diesel engines, whether used in connection with electricity supply work, or otherwise. The entrance fee is \$5.00, approximately, and the annual subscription is \$5.00, approximately. An American member can nominate a deputy to attend the valuable lectures and meetings held by the association. Persons or firm not qualified for full membership may become subscribers on payment of an annual subscription of \$5.00, approximately. Full particulars can be obtained from Mr. Percy Still, Hon. Secretary, 19 Cadogan Gardens, London, S. W. 3, England.

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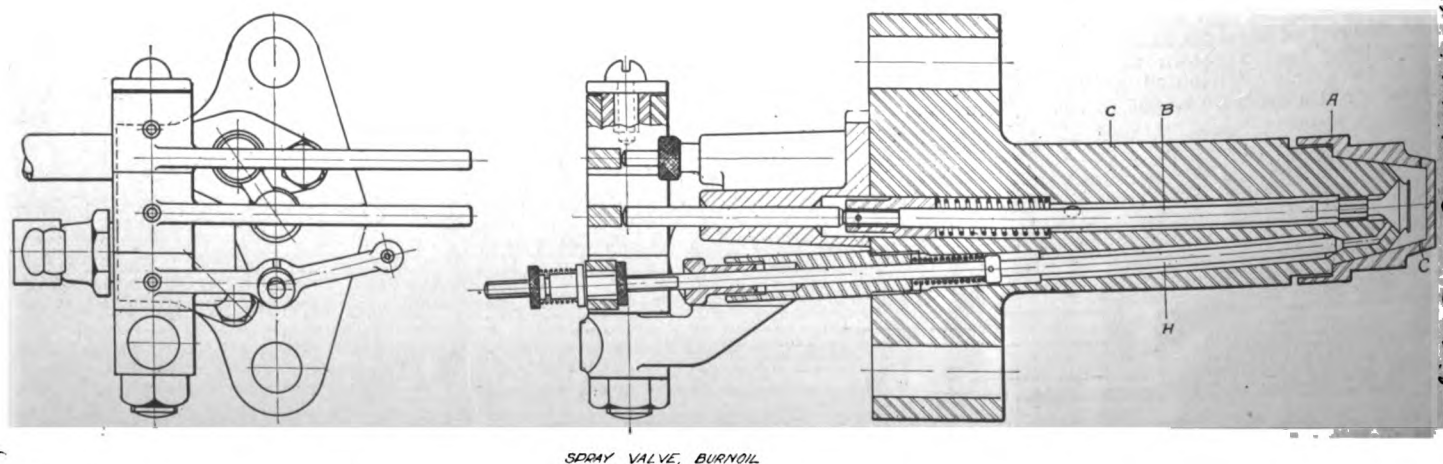


Fig. 24. The Hvid-Brons fuel-injector as used with the Burnoil engines

# Trials of M. S. "Alabama"

New 1,000 b. h. p. Diesel-Driven Vessel of 4,000 tons Deadweight Capacity Makes a Speed of Over 10 Knots on a Fuel Consumption of 1.29 Barrels of Crude-Oil per Hour.

SINCE going to press with our August issue, wherein an illustration and a brief description of the new full-powered twin-screw wooden motorship "Alabama" were given, this vessel has run her official trials, and the latter indicate that she will be the most economical ship to operate of all commercial-craft on the Pacific Coast. But, whether she will be kept on this coast we are not sure at the time of writing, as she has been sold to French interests by her builders and owners, the Alaska Pacific Construction Company of Seattle.

On the trials Calor fuel of 23 degrees Baumé 0.91 specific gravity, and having 25% asphaltum, was used, and the following are the fuel-consumption figures:

Average consumption per brake h.p. hour, 0.41 lbs.  
Average consumption per 1,000 h.p. hour, 410 lbs.  
Average consumption per 1,000 h.p. hour, 54.1 gals.  
Average consumption per 1,000 24 hour, 31 bbls.  
Cruising-radius at full load, and at speed of 10.3 knots, with fuel tankage of 1,300 bbls. = 38 days (9,393 nautical miles).

The engines being new they were kept flooded with lubricating oil, so no accurate oil-consumption data was obtained; but, judging by another ship with similar power and same make of engines—the "Cethana"—the consumption will not exceed 16 gallons per 24 hours for both motors. After the oil is used on the cylinders, it is collected and passed through a Peterson filter and then used to lubricate the main-bearings, camshaft, etc.

During the maneuvering test the two main Diesel engines carried out every signal smoothly and easily. The time for full-ahead to full-astern was 15 seconds. To start from stand-by took 7 seconds. No doubt this time will be speeded-up when the engineers are more familiar with the machinery.

Previous to the trials the hull had lain in the water for four months so the bottom was foul. The dock-test lasted an hour, the engines turning at half-speed. Also for the first half-hour of the trial sea-trip the engines were run at half speed. With the motors at full-load there was no vibration in the engine-room and only a slight vibration on deck at midships.

The trials were run with the ship light, the weight of the vessel being 3,028 tons (block-Co-efficient of 0.72) so, as she is designed to carry 4,000 tons of cargo in her holds including fuel, we are inclined to think that the "Alabama" is a little under powered and that she should have several hundred more horse-power. It is in the interests of both the motorship building and oil-engine industries to point this out wherever such is the case; because, if a motor vessel fails to maintain a good speed when loaded and in service, there will not be lacking critics who will spread exaggerated reports and rumors. Also it sometimes will mean that her owners will have every ounce of power used continuously in order to keep up the vessel's speed. That, of course, strains the machinery, and sooner or later causes trouble to develop. Just the same remarks, of course, would apply to steam-engines if they were a new development and were surrounded by opposition.

The following are the speed tests of the "Alabama":

1. Alki Point to Vashon Point—Against tide.  
Time—11:18 to 11:41 A.M. = .366 hrs.  
Distance—3.67 Naut. miles.  
Speed—10.00 knots (average r.p.m. 188).

2. Ten Mile Test—Slack tide.  
Time—12:51 to 1:48 P.M. = .95 hrs.  
Distance—10 Naut. miles.  
Speed—10.5 knots (average r.p.m. 187.5).
3. Point Vashon to Point Brale (Slack tide).  
Time—2:10 to 2:28 = .3 hrs.  
Distance—3.125 Naut. miles.  
Speed—10.4 knots (average r.p.m. 188).
4. Dolphin Point to Alki Point—Against tide.  
Time—3:14 to 3:41 = .45 hrs.  
Distance—4.6 Naut. miles.  
Speed—10.2 knots (average r.p.m. 188).  
(Air-injection pressure steady at 900 lbs.)

In view of our above remarks it will be realized that this performance is a most excellent one, speaking well for the design of the ship and for the operation of her Diesel-type engines. The



Photo S. I. M. French Ministry of Marine

On the lookout for hostile U-boats aboard a French patrol-ship.

"Alabama" was, by the way, designed by Mr. E. B. Shock. The following is an analysis of the 10-miles speed test; the sea was smooth and the tide slack:

ENGINES		
	Port	Star'b.
Loan Percentage.....	116.2	116.2
Mechanical Efficiency.....	78%	78%
Number of Rev. per Minute.....	187.5	187.5
Brake-Horse-Power.....	552.3	552.3
Elapsed Time (Minutes and Seconds).....	57'-0"	57'-0"
Fuel-Consumption in Pounds.....	463.98	
Fuel-Consumption per Brake h.p. Hour.....	0.422	0.422
Air-Injection Pressure in Pounds.....	900	900
Exhaust-Gases.....	Clear	Clear
Cooling-Water Discharge Fahr.....	118°	118°
Speed in Knots.....	10.5	

Owing to the presence of obstructive flanges on the water-jackets of the exhaust manifold of the two main engines, it was not found possible to install indicator, instruments, consequently no cards

could be taken. Therefore, the brake h.p. load percentages, etc., were figured by accurately measuring the fuel-consumption during the 10-miles speed run by means of a gauge rigged on the service fuel tank, and expressed as follows:

$$20.35 \times 22.8 = 1104.7 = 552.3 \text{ B.H.P. each Engine}$$

0.42  
2  
20.35 = Consumption in Inches  
22.8 = Lbs. per Inch of Tank  
0.42 = Average Consumption at 185 R.P.M. and Normal Load of 476.7 B.H.P.

Whilst the figures obtained in this case may be accurate, or nearly accurate, it is most difficult to ascertain the exact power an engine is developing once it is installed in a ship, although it may be figured very closely by means of a torsionmeter on the shafting. The method usually adopted with four-cycle Diesel engine motorships is to take indicator-cards and then deduct 25% from the indicated horse-power. With a two-cycle Diesel engine ship at least 30% would have to be deducted. However, as mentioned, in this case indicator-cards could not be secured.

There is no need to repeat details of her two main Diesel engines, as these are two six-cylinder 500 b.h.p. McIntosh & Seymour motors, exactly similar to those in the "Cethana" detailed on another page of this issue.

## HULL

Displacement (loaded).....	7,028 tons
Displacement (light).....	3,028 tons
Dead-Weight-Capacity.....	4,000 tons
Actual Cargo-Capacity.....	180,000 cu. ft.
Lumber Capacity.....	2,000,000 ft.
Gross Tonnage.....	2,088 tons
Net Tonnage.....	1,654 tons
Fuel-Capacity.....	1,200 bbls.
Water-Capacity.....	200 bbls.
Length O. A.....	270' 0"
Length, B. P.....	252' 0"
Breadth, Molded.....	46' 0"
Depth, Molded.....	26' 6"
Depth of Hold.....	19' 6"
Light Draught Forward.....	7' 6"
Light Draught Aft.....	16' 6"
Loaded Draught (mean).....	24' 0"
Propeller.....	Cast Iron 8' dia. x 6' 4" pitch with 14.2 sq. ft. projected area and 15.8 sq. ft. developed area
Tail-Shaft.....	9" dia.
Length of Engine-room (Bulk-head to Steam tube).....	42' 0"

## AUXILIARY MACHINERY OF M.S. "ALABAMA"

There is a 75 b.h.p. Fairbanks Morse oil-engine of the surface-ignition type directly connected to a 40 K.W. 320 Amp. 125 Volt D.C. generator. There also is a 36 b.h.p. Miez engine of the same class belted to a 26 K.W. 208 Amp. 125 Volt D. C. generator. These motors supply the electric current for the ship. The heating, by the way, is electrical and not by steam.

On deck the 25 h.p. windlass and four 15 h.p. cargo winches are electrically operated, the latter being placed in pairs fore and aft. Furthermore, down below in the engine-room the high-pressure auxiliary air-compressor, the 225-gallon fire-pump, fuel-oil pumps, circulating-water and bilge pumps all are electrically driven. But the storage batteries are on deck. The 75 h.p. Fairbanks Morse set is installed amidship between the two tail-shafts where it is accessible, but where it takes up little room in space otherwise not used.

## GREAT INCREASE IN CAPITAL

Gio Ansaldo & Company, of Genoa, the great Italian motorship, submarine, warship, and marine Diesel-engine builders, have increased their capital to 500 millions (500,000,000) of lire, fully paid. This firm has twenty-three works, and ten associated companies, and is one of the largest engineering concerns in Italy, if not in the world.

## ANOTHER BIG STEAMER CONVERTED

The steel steamer "Lidvard," built by Barclay Curle in 1909 for the East Asiatic Company, has been converted by her owners to Diesel motor power. She is of 3,409 tons gross, 330 ft. long, by 47 ft. breadth and 17.7 ft. depth. A six-cylinder 26% in. x 39% in. B. & W. type motor has been installed by Harland & Wolff's Diesel-engine Department. This makes the fourth large steamer which the East Asiatic Company have had converted and we expect their entire old steamship fleet soon will be motorships. This refers to their old steamships operated by a new and specially formed company.



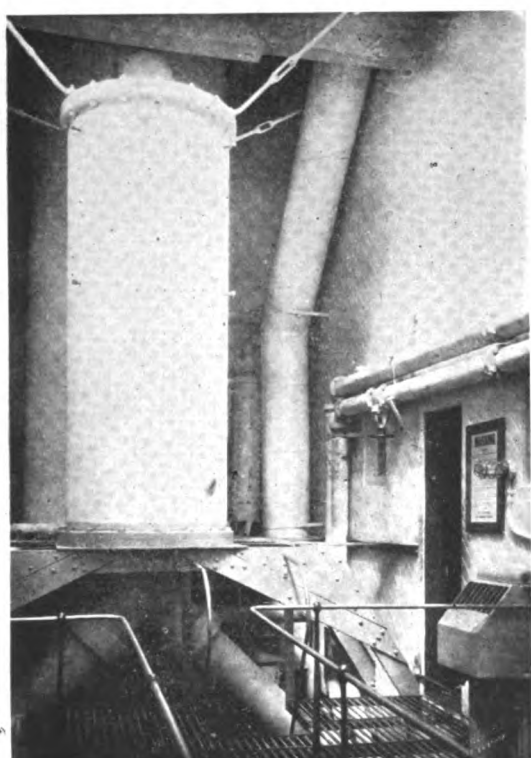
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A motor gun-barge on the river Piave, Italy. Craft of this type have done useful work against the Austrians.

## SILENCERS ON MOTORSHIPS

On one large triple-screw, surface-ignition, oil-engined motorship the navigator on the bridge hardly could hear the signals of passing ships owing to the clang and rattle caused by the exhaust-gases from the engines vibrating the metal smoke-stack, the latter also acting as an outlet for the smoke from the donkey-boiler. This was not the fault of the engines, but of the installation. There was a simple type of silencer on each of the three engines and the exhaust-gases from these were lead to the ship's funnel and extended half-way up. Naturally the force of the expanding gases acted like hammer blows on the walls of the stack. The remedy, of course, would have been very simple to effect, but we do not know if anything was ever done.

In some big motorships there are efficient silencers, often brick lined, in the engine-room, and the exhaust-gases are carried up one of the hollow masts of the ship where it exists through slots. This is a very excellent system! With one ship the smoke from the galley-fire also was carried up this mast, with the result that the officers were constantly worried, and amused, by signals from passing ships informing them that their mast was on fire.



The Maxim silencer in the motorship "Cethana."

In the case of a new four-cycle Diesel-driven twin-screw wooden motorship built on the Pacific Coast, the engine exhausts lead into a large Maxim silencer placed forward of the engine-room at 'tween deck level, whereas the discharge is into a smoke-stack of ordinary size. This silencer is of the cast-iron cylindrical type with six expanding coils secured to the bottom of the cylinder; the exhaust gases passing in at the bottom of the cylinder and being expanded through the coils very frequently, reaching the funnel with no coloring or pressure. The exhaust gases are expanded in this silencer from the engine to 0.711 lb. per square inch. The silencer is coated with magnesium insulation, eliminating chance of any outside heating. In service it has proved very efficient, and no noise or pulsation from the main engines are noticeable at any time.

But in this ship the exhaust gases from two surface-ignition two-cycle type auxiliary oil-engines are lead into the stack separately from the "silenced" main engine exhaust. Consequently these particular exhausts are very noticeable and can be heard some distance away from the ship, thus defeating the object of the Maxim silencer. It was not advisable to connect the auxiliary engine exhaust to the main silencer on account of back-pressure that would lower their efficiency, the auxiliary engines being of the two-cycle port-scampering type. However, there was no reason why large water-jacketed boxes could not have been installed especially for the auxiliary motors and thus effectively silenced them. This is one of the little things that shipowners and naval architects learn by experience, and its publication in "Motorship," together with hundreds of other typical cases, will enable other shipowners to avoid similar errors and so save time and expense.

## TEN-THOUSAND TON MOTOR AUXILIARIES

(Continued from Page 8)

at 12 knots speed; but her average fuel consumption would jump to one-hundred and twenty-five barrels per 24-hour day. Consequently, the question is, would it not pay to build a full-powered motorship, and is there any real economy to be gained from the auxiliary canvas? On the other hand, a machinery breakdown will not affect her if the wind is favorable.

It is a simple matter to compare her with a steamship a 7,000 tons actual cargo capacity (not dead-weight-capacity). A steamer of such capacity and speed, if of the latest and most economical geared-turbine type will use 310 barrels of oil per day as fuel, or if coal-burning will use about 55 tons of coal (equivalent to 385 barrels of oil) per day. And, because of the stokers needed, will require as many in the total crew as does a motor auxiliary like the "France." Furthermore, the steamer will have to be very much larger in dimensions and displacement (over a thousand tons) to carry this amount of cargo, consequently her first cost, etc., will be considerably higher than that of the "France," or of the full-powered motorship. The cost of construction of a full-powered motor ship probably, only will be a little higher than that of the "France" as she would have very similar dimensions.

Therefore, there is no near approaching economical comparison between the big auxiliary and the steamer, everything easily being in favor of the auxiliary. But there is not so much difference between the auxiliary and the full-powered motorship.

The difference between the fuel consumptions of the auxiliary and of the steamship alone is enormous, apart from other features. With oil at \$1.75 per barrel and each ship spending 250 days at sea during the year, the oil-fired steamer will have a fuel bill of \$135,625.00, while the auxiliary will have a fuel bill of \$17,500, which means a direct annual economy, in favor of the latter, of \$118,125.00 without taking into account the great increase in stand-by charges.

## DIESEL ENGINE CONSTRUCTION IN ITALY

From information received, we learn that the Officini Insubri of Milan, Italy, have been absorbed by Messrs. Franco Tosi Company of Legano, and of 82 Wall Street, New York, who have a capital of 64,000,000 Lire and have authorization to increase the same to 80,000,000 Lire (\$16,000,000 normal exchange). Both companies are large constructors of marine, mercantile and naval Diesel-type oil engines.

## 278 SCOTTISH FISHING-BOATS FITTED WITH MOTORS DURING 1917

According to the Scottish Fishery Board there were no fewer than 1,262 fishing-vessels fitted with motors up to the end of 1917, or an increase of 278 over the previous year. At Fraserburgh, Peterhead, Banff, Buckie, Anstruther and Aberdeen, over 130 deep-sea "Fife's" and "Zulus" have been given suitable installations and the powers range from 45 to 75 h.p. In the small line-fishing West Coast craft the motors are of 6 to 10 h.p.; but in future it is expected that motors of 20 to 30 h.p. will be installed. There are practically no gasoline-driven boats, all craft using kerosene or heavy-oil; but rapid starting appeals to the fishermen. As there are about 10,000 fishing vessels yet without power there obviously is a good opportunity for some enterprising American oil-engine builders to get busy.

## SCOTTISH MOTORSHIP "GLENNAVY"

Among new British steel motorships of large size is the "Glenavy," a freighter of 5,075 tons gross, built for the Glen Line by Harland & Wolff, and engined by the Diesel Engine Department of Harland & Wolff. The following are her dimensions:

Length ..... 385.1 ft.  
Breadth ..... 52.2 ft.  
Depth ..... 30.3 ft.

Her two B. & W. type Diesel engines have six-cylinders 24 13/16 in. bore by 33 1/2 in. stroke. It may be remembered that it was reported that the Glen Line are building a large fleet of these motorships. Several sister motorships to the "Glenavy" now have been in service for three or four years.

## ANOTHER CHINESE CONCRETE MOTOR VESSEL

A 65-ft. motor-driven concrete vessel has been launched by the Yangtzepoo Dock Company of Shanghai, and the builders claim they only need three weeks to duplicate the boat. She is fitted with kerosene engines and will be used for touring in Shanghai harbor.

Mons. E. Colin, General-Representative in America of Schneider et Compagnie, New York, Paris and Creusot, recently has suffered a very sad bereavement. He was suddenly called back to France owing to the serious illness of his wife, only to be met with the sad news that she had passed away while he was on the high seas en route. We feel sure that Mr. Colin's many American friends will deeply sympathize with him over his great loss, and we extend our sincerest condolence.

## NEW JAPANESE MOTORSHIPS

There recently was placed in service in Japan the motorship "Jiro Maru," a steel vessel of 850 tons gross, owned by the Mitsu Bishi Goshi of Kaisha, Japan. This vessel was built by the Mitsubishi Zosen Kaisha, Ltd., of Nagasaki, and fitted with a four-cylinder 17 1/2 in. by 20 in. oil-engine constructed at the Nijigata Iron Works at Nijigata. The length of the "Jiro Maru" is 180 ft., by 32 ft. breadth and 22 ft. depth.

## BUNKER-COAL COMPANY OWNS MOTORSHIPS

So marked is the economy of oil-engined motorships that the A/S Kjobenhavns Bunker Coal Depot of Copenhagen, Denmark, has had built by Burmister & Wain a single-screw Diesel-driven steel ship of 1,660 gross tons. This vessel is fitted with a three-cylinder 25 in. x 26 in. B. & W. Diesel engine, and probably is the first instance of a three-cylinder motor of this make being installed, all their engines previously having six or eight cylinders. The "Trask" is 255 ft. long by 37 ft. breadth and 17 ft. depth.

## BOOK REVIEWS

**Jane's Fighting Ships for 1917.**—Published by Sampson Low, Marston & Co. Ltd., Southwark Street, London (25 s/d). Published in the U. S. A. by Van Nostrand & Company; price, \$10.00. It had been our intention to review this most interesting and valuable book several months ago, but extraordinary pressure on space and time has been a preventing factor. Despite the difficulties caused by the Great War, this new edition displays many improvements over preceding issues. On the illustrative side, more than three hundred alterations have been made, in the form of new photographs, new or improved silhouettes, plans, and other illustrations. Unfortunately all illustrations of pre-war British and American war-ships have been deleted at the request of the British and American Admiralties. Inclusion of these pictures would be of very little extra value to Germany, because photographs and picture postcards of United States warships still are freely published and circulated throughout the United States. Also it is a well-known fact that every German submarine carries a copy of what is virtually a reprinted issue of "Fighting Ships."

Every reliable item of possible use and interest, suitable for publication, has been gathered together for the pages describing the belligerent Navies. The German Navy Section contains much novel information. For the first time, in this or any other country, details are given to the public of new German Mine-Laying Light Cruisers, of nine new classes of enemy Destroyers, the "General Service" U-boats.

The German Submarine Section is the result of many months' careful study and research. New and large silhouettes are given of the hostile underwater craft, including the latest types. Nowhere else can such a wealth of detail be found regarding the German fleet. For instance, one important feature added this year is the anti-aircraft batteries now mounted in German warships.

Since the death of Fred Jane, "Fighting Ships" has been edited by that well-known naval writer, Maurice Prendergast, who is more than maintaining the reputation of this excellent publication.

**Oakum and Kindred Products.**—Published by Geo. Stratford Oakum Company, Jersey City, N. J. Obtainable gratis upon application by mentioning "Motorship." This interesting little book should be read by all connected with ships, as some most useful information can be obtained concerning oakum and its kindred products. There are included some excellent pictures of ships and warships, not to overlook the motorships "City of Portland," "Seaborn," "Carnegie," "June," etc., which are caulked with Stratford Oakum.

**"Audacious Adventures of Miles McGonaghy."** by Arthur D. Howden Smith. Published by Geo. H. Doran Company, New York. To those who like dashing tales of the sea this series of short stories will appeal. Miles McGonaghy is a modern Captain Kettle with a strong dislike for anything Irish or English, naval officials in particular, and who is very much insulted unless scribed as a Britisher—until the end of the book. His various daring adventures on the high seas against our common foes make rattling good reading for those who do not mind stories written in dialect, and are to be numbered among the best of the kind that we have read for a long while. Capt. McGonaghy is a Presbyterian Ulsterman who speaks with a decided Scotch brogue.

**How Wooden Ships Are Built,** by H. Col. Estep. Published by the Penton Publishing Company, Cleveland, Ohio. In these days of wooden motorships, wooden steamships, and wooden sailing vessels, a new treatise on the subject of wooden ship construction comes at an opportune moment. The work "How Wooden Ships Are Built" is the reprint in book form of a series of valuable articles and no doubt will be welcomed by those interested in ships. The drawings and photographs are very profuse and many motorships are illustrated.

# The Heavy-Oil Engine From a Scientific Standpoint

By Dr. CHAS. E. LUCKE

Part IV. (Continued from July issue.) The Discussion.

The Chairman: Gentlemen, in presenting Dr. Lucke this evening I made the broad assertion that the gentleman would speak for himself. I do not doubt that you all agree with me that we are particularly happy tonight to have a man as busy as Dr. Lucke with us to tell us about this all-important subject, and I am sure that Dr. Lucke will be glad to answer any questions that anybody has to ask him.

Mr. Newkirk: Will you kindly tell us something about the development along the airplane line of this type of engine?

Dr. Lucke: Do I understand that your question is concerning the application of the heavy oil engine to airplanes?

Mr. Newkirk: Yes, sir.

Dr. Lucke: I think the possibilities there are quite remote, because the airplane engine must be primarily light. In proportion as it is light so does the airplane rapidly increase in value, especially military value. As you know, our new Liberty motor weighs about two pounds per horsepower. Now, the heavy oil engine necessarily involves high pressures, and the high pressures mean increased metal weights. The heavy oil engine, to be economical, must be late injection, and so far we have never learned how to carry out late injection at high speed. I think it is not impossible, but it has not been done up to the present and probably will not be for a long time, if ever. I do not know. It is quite sure, however, that the airplane engine will have to be a pre-mixture engine, a carburetor type engine of moderate compression, as much as it can stand, making the mixture before hand, without very high maximum pressures and with the minimum possible weight of material. That is more important—the overall weight of engine—than any other thing. I think this heavy oil system is poorly adapted to that particular problem. Any other question?

Gentlemen, I am perfectly willing to answer any question I can.

Mr. Boyd: What is the proportion of the material used in the Standard engine as compared with that of the Diesel engine? It is a well-known fact that, owing to the weight of the Diesel engine, it was not found possible to use that type of engine on our chasers and they were compelled to use a slower and lower compression engine of the standard type.

Dr. Lucke: Submarine chasers have engines, Standard construction, Otto cycle carburetor, 8-cylinder, 10"x11", 225 to 250 h. p. three units. That engine is far from perfect; it can be criticized in a great many ways, but nevertheless if you look around the market I believe that you will agree with the Naval authorities that it was the best bet at the time. But if you want to go into the future, we can build a heavy oil engine that will do that work—the same size or smaller size or larger size. Of course, the fuel consumption would be about half what it now is—just about half. As to weight, we can certainly make it as light—guarantee to make it as light per h. p.

Dr. Carl Hering: What is the relative amount of energy in the heavy oil as compared with the gasoline?

Dr. Lucke: The question is, "What is the relative amount of energy in the heavy as compared with the light oil?"

Dr. Hering: Per gallon and per dollar.

Dr. Lucke: Well, I will give it to you in other units and you can figure the rest out for yourself. The B. T. U. per pound is equal to 18,340+40 times (Baume -10), Baume being the gravity of the oil. You see, then, it varies with the density of the oil. That formula is pretty close—within 1%. Now, the heavy oil is a little lower in a calorific power per pound, and you can take any heavy oil you please and compare it with gasoline and kerosene as to B. T. U. per lb. and per gallon and apply the price to it, but whatever price you apply you had better get over the telephone

because it won't be the same as yesterday. The relative consumptions are nearly all in carburetor type vs. injection type engines.

Mr. Jos. A. Steinmetz: You have made a very attractive picture of the possibilities of those improvements in the heavy oil engine. Is the National Government working along that line, and will we get such an engine?

Dr. Lucke: The National Government has done something along the lines of inquiring into the possibilities, I think. I have to be very careful here. This is a confidential situation in time of war, you know.

The Chairman: You will not be quoted.

Dr. Lucke: They are interested and they have inquired and there are some plans being formed. Just what they are or whether they will be executed or not, is, I believe, up to Congress. The Naval authorities want to do something. I know that. In the meantime some private firms and some individuals are working; but it is quite evident, if you think about it, that they cannot get very far in business on prospects for orders, in view of the enormous costs involved. Just consider building the first model of an engine of a couple of thousand horsepower. It runs into tremendous sums of money, and if it does not work, as is almost sure to happen with the first model—then some of the work has to be done over again. There must be some large interests back of a thing like that or it cannot go, and that is what we have always failed to have here. Our Standard Oil Company have always encouraged this sort of development. The Texas Oil Co. has always encouraged this sort of development, but never spent a nickel to help it. They always encourage by saying "Fine! Go ahead!" Of course, they hope we succeed; it is money in their pocket if we do. But they never spent a nickel nor have they offered anybody a nickel to work on it. I do not see much prospect of success commercially along engineering lines until some great interests take it up as a public necessity and put into it the money it needs with the confidence in their ability to use the product, and get the money back.

Mr. Steinmetz: It would take a million dollars, probably, wouldn't it?

Dr. Lucke: To develop one engine? Yes, easily. I know what Mr. Steinmetz means. I understand it exactly. It needs to get ready for the production of that engine, perfected as to design, and jigs, shop equipment and organization. It would easily take a million dollars.

A Member: Doctor, I would like to inquire if you know of any engine now on the market that employs more than one stream of oil in the upper head.

Dr. Lucke: Well, there is some doubt as to what constitutes being on the market. There is some such engine in operation.

Mr. Steinmetz: It is pretty tough, doctor. They are shooting \$100,000,000 a day into scrap.

Dr. Lucke: Yes, sir.

The Chairman: Mr. Bonine, will you say something on this subject?

Mr. Bonine: Dr. Lucke mentioned the use of the oil engine was necessary in ships and probably becoming necessary in automobiles and in direct-connected generating sets. Is not there also a possibility that the heavy oil engine is absolutely necessary for use in gasoline-electric cars for inter-urban work and for switching engines where we have heavy complicated tracks and cannot use at the present time the third rail because of the track difficulties.

Dr. Lucke: Yes, sir, you are quite right, and I had in mind all of that possibility. I should have made that clear. To my mind the automobile type of engine includes the engine for the truck for the tractor and various types of railroad equipment. The gasoline locomotive will become an oil locomotive. The gasoline electric car will become an oil electric car. It

is becoming so now. One already has been changed over and the others will have to follow in due course, because they cannot afford not to.

Mr. Bonine: There is another question I want to ask in regard to ignition. In a Diesel engine you have a refrigerating effect—a very pronounced refrigerating effect with the air which is used to spray the fuel into the hot, compressed gases or air in the cylinder. Now, you mentioned that it was possible to create an oil fog. Aren't there two stages to the combustion of an oil fog? Can you get solid combustion? Is there not such a thing as burning a solid without that solid first having to be put into a gaseous state? Solids do not burn, do they, without becoming gases? Isn't there a time element involved in changing the solid, small particles of oil into a gas, so as to come in contact with the air before they burn?

Dr. Lucke: That is a controversial question. I think you might take either side—one or the other. It has always been assumed that all combustion was really gaseous, and if a solid or liquid burned it burned by passing through a vaporizing or gasifying stage. And that may well be. I think if the particle—the size of the particle—liquid drop or solid dust particle is large, it is undoubtedly true. But now consider a smaller size of liquid drop or dust—flour dust and coal dust, both of which we know explode in air and wreck buildings at times. If you will follow in your mind's eye the reduction of size of particle you are bound to see that the limit of that is the infinitesimal particle that is substantially the gaseous molecule, in which case what is the difference?

Mr. Bonine: Is it a gas, though?

Dr. Lucke: It is exactly, to my mind, similar to the critical state between liquid and vapor at high pressures when the density of liquid is equal to the density of vapor. Is the substance liquid or is it vapor? No one knows and no one cares. The practical fact is this: that if coal dust or any other solid combustible is fine enough and rightly scattered through air it will explode, and explode as sharply and cleanly as if it was gaseous (except for ash). It is also true if an oil fog is fine enough and well scattered through air and exploded, that it explodes quite as well as if you had methane or any of the straight gaseous hydrocarbons mixed with air. Therefore, whether the intermediate stage is there or not, becomes a matter of speculation, and will remain such. The important thing is that it does not matter. In the engine we can work splendidly without knowing.

Dr. Hering: The fact that Dr. Lucke has kept a rather large audience here until a very late hour is sufficient to assure him of our appreciation of this very interesting and entertaining address, but nevertheless I take great pleasure in offering Dr. Lucke a vote of thanks for the pains he has taken to come and speak to us about this most interesting field of work in which he has been so actively engaged.

The Chairman: We have had the pleasure of listening to the most exhaustive and lucid technical address that has ever been delivered before this Club, and it is moved and seconded a vote of thanks be extended to Dr. Lucke. All in favor will signify by rising. (Everyone standing.) The meeting is adjourned.

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## "Motorship" Illustrated Patent Record

Selected Abstracts of Recent Published Patents of Internal Combustion Engines

Copies of original specifications may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

Compiled and Described by H. Schreck, Member American Society Mechanical Engineers

1,265,029 May 7, 1918. Starting Gear. J. W. Anderson of New London, Conn., Assignor to Electric Boat Co. of New York, N. Y.

This invention (no illustration) refers to the starting gear of the above described engine and, therefore, the above illustration Fig. 1 illustrates also this arrangement. The starting valves "24" and the injection valves "12" are operated by the respective cams "20" and "19" attached to a single body "18" which can be shifted on the cam shaft by means of the hand lever "25". The two cams are arranged on the body at such a distance that only one of these two valves can be operated at a time, the roller of the rocker of the other valve is then running on the base circle of the cam body.

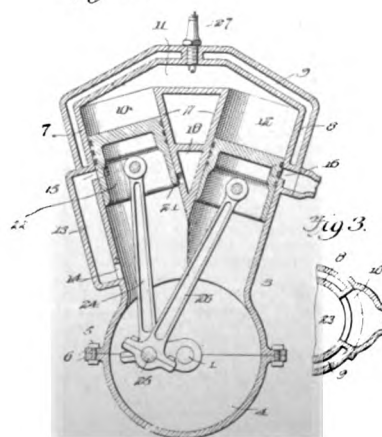
The inventor claims that in an internal combustion engine, a plurality of cylinders each having an air inlet valve, a fuel-spray valve, an exhaust valve, and a compressed air starting valve; operating devices for the valves; a cam shaft driven by the engine; a plurality of spaced sleeves splined on the cam shaft; a plurality of cams on each sleeve, each cam actuating one of the operating devices; a slide rod alongside the cam shaft; and a plurality of shippers secure to the slide rod, one for engaging each of the sleeves, whereby the slide rod may be positioned either to set a cam on each sleeve to operate the air starting valve of a cylinder or to set a cam on each sleeve to operate the fuel-spray valve of a cylinder.

1,265,596 May 7, 1918. V-type Engine. W. J. Blatt of Hollidaysburg, Pa.

This invention relates to a V-type engine working on the two-cycle principle. The pistons being at their upper dead center, a charge of explosive mixture is

drawn through opening "21" into the crank case. This mixture is being compressed in the crank case by the downward movement of the pistons and then discharged into the cylinder as soon as the piston uncovers port "15." The exhaust ports are at "16."

Fig. 1.

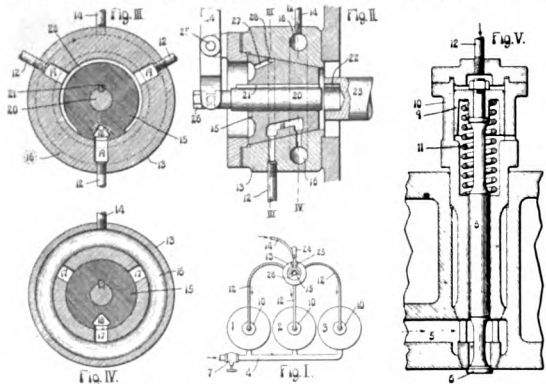


The cylinder construction reminds one of the two-cycle V-type Diesel-engine, developed by the General Electric Co., on which engine is employed a similar design of cylinder head with the difference that the common combustion chambers are connecting each two cylinders adjacent in the longitudinal direction of the engine. In this case the scavenging air pumps are arranged on the vertical centerline of the engine, i. e., in the opening of the V between such pairs of cylinders.

The inventor claims that an internal combustion engine embodying companion cylinders arranged in angular relation to each other, a cylinder head common to both cylinders, a crank case common to both of said cylinders, a combustion chamber common to both of said cylinders, one of said cylinders being formed with a by-pass leading from the crank case to said combustion chamber, a spark plug located centrally of said common cylinder head, the other cylinder being formed with an exhaust port, pistons working in said cylinders, a common crank shaft, and connecting rods between said pistons and the same crank arm of said shaft, the arrangement of the intake and exhaust ports being such that one piston travels in advance of the other piston, causing the exhaust port to be opened before the inlet port and also to be closed while the inlet port is opened, and a charge receiving chamber located between the cylinders and formed by the walls thereof, the wall of said charge receiving chamber being formed with a port leading to the crank case and covered and uncovered by one of said pistons, the last named port being so located that in one position of the piston in the charging cylinder, said port is closed while the discharge end of the by-pass is open.

1,098,767. June 2, 1914. Air Starting Device. H. R. Setz of St. Louis, Mo., Assignor to Fulton Iron Works, of St. Louis, Mo.

This invention is serving the same purpose as described above. For the starting movement of the engine the distributing valve "15" is connected by the slidable valve stem "20" to the gear shaft and will be disengaged after the engine is running on oil. The starting air is supplied at "14", enters the annular chamber "16" and is then distributed thro port "18" and the holes "17" at the proper time to one of the connections "12" which are leading to the starting valves (Fig. V.) in the cylinder heads. After one of the cylinders is cut off from starting air its piping is allowed to exhaust thro a peripheral exhaust channel "28" and exhaust port "27." This device may be used either for

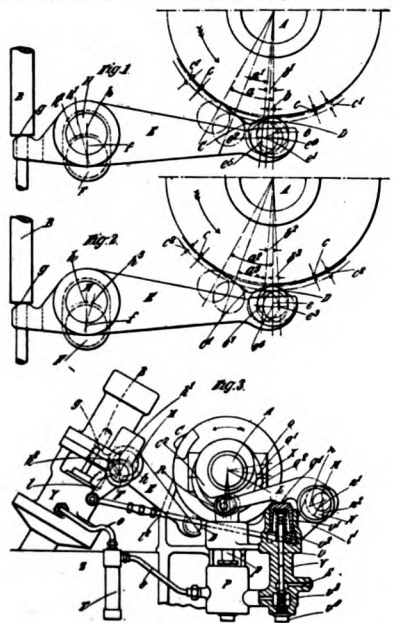


distributing the starting air directly or, preferably as the inventor claims, for distributing air for controlling certain inlet devices.

The inventor claims that in a starting device for internal combustion engines, the combination of means for conducting fluid under pressure to the engine cylinders, inlet devices for controlling the admission of fluid to said engine cylinders, and means for controlling said inlet devices, the last named means including a valve casing having an annular valve seat, and a series of inlet ports leading to said annular valve seat, said valve casing also having a series of discharge ports leading from said annular valve seat and corresponding in number to the number of said inlet ports, a rotary valve having an inlet port adapted to register successively with the inlet ports in the valve casing and also having a discharge port adapted to register successively with said discharge ports, said valve being provided with a passageway leading from its inlet port to its discharge port.

1,265,799. May 14, 1918. Adjustable Timing of Fuel Injection. J. McKechnie of Barrow-in-Furness, England, Assignor to Vickers Ltd., of Westminster, England.

This invention refers to an adjustment of the stroke and timing of the fuel valve so as to take care of the variation in oil-consumption according to load and speed of the engine. This object is attained by changing the relative position of the fuel cam to its roller. Fig. 1 shows the application on a constant speed engine, such as, a dynamo engine. The fulcrum of the rocker arm is mounted on an adjustable eccentric whose rotary rotation brings the roller in such a position that altho



the duration of opening of the needle is reduced the point of opening, i. e., in regard to the dead center, remains almost the same as before. Fig. 2 shows the application on a variable speed engine, such as, a marine engine. In this case the eccentric is arranged in such a way that the fuel injection, as desirable, will be retarded as well as the duration of the opening reduced when the power of the engine decreases. Fig. 3 shows this arrangement in connection with a simultaneous regulation of the fuel pump supply.

The inventor claims a fuel injecting mechanism for internal combustion engines, comprising an injection valve, an adjustable valve lever, a lever operating cam having the outline of its leading surface so related to the path of adjustment of the lever as to time the valve opening for all adjustments of the lever, a fuel pump including a suction valve, a suction valve cam, an adjustable cam lever through which the suction valve is operated and means for effecting the simultaneous adjustment of the injection and suction valve levers.

1,264,994. May 7, 1918. Air Starting Device. H. W. Sumner of Winslow, Wash.

This invention relates to an air distributing valve for the starting of oil-engines combined with a reversing mechanism. The distributing valve which is illustrated in Fig. 2 to 5 may be connected to or mounted on the gear shaft. The casing has two air inlets "21" and "22," which, from the four-way valve Fig. 6, are charged one

or the other depending which way the engine is to run. The cylinders which are connected individually to the various openings "20" will receive the charge of starting air according to the port "11" registering with one or two of these openings, each in succession, as the valve is rotated. If the engine is to be operated in the oppo-

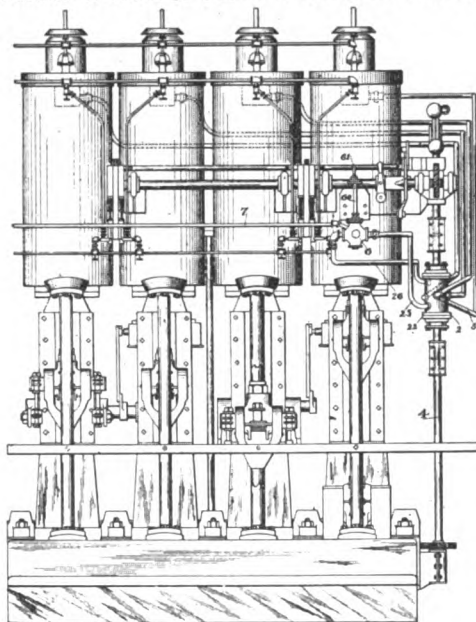
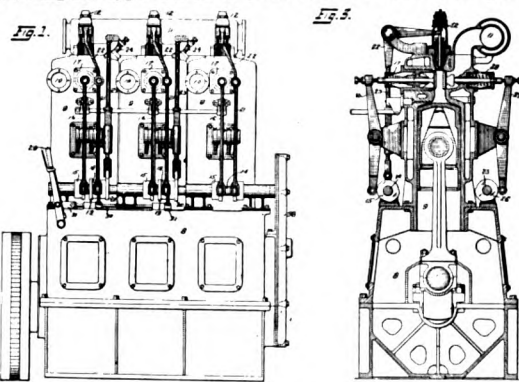


Fig. 1

site direction the four-way valve, Fig. 6, will change the air supply from connection "22" to "21," the air will then force down the distributing valve and in this case the port "12" will time the opening to the respective cylinder connection.

The inventor claims an air starting mechanism for internal combustion engines, comprising a rotative air distributing valve mounted to turn in conformity with the engine shaft and to be moved axially and having two discharge ports separated both axially and angularly and adapted to communicate with pipes leading to the respective cylinders, and a supply connection with each end of the valve.

1,258,658. Mar. 12, 1918. Diesel-engine Type. G. C. Davison and J. W. Anderson of New London, Conn., Assignors to Electric Boat Co. of New York, N. Y. This invention represents the well-known New London Engine type which the inventors claim to be par-

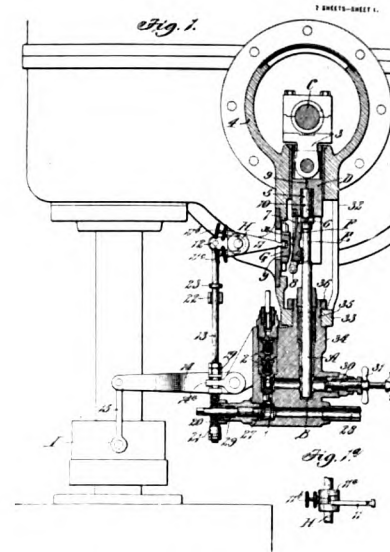


ticularly adapted for the use on submarine boats where the restrictions as to space occupied are unusually severe. As one of the principal advantages it is claimed that a complete cylinder unit including valves and their mechanism can be removed and replaced without disassembling or readjustment of the rest of the engine.

The inventors claim that in an internal combustion engine, the combination of a casing, a cylinder mounted thereon, a piston in the cylinder, an engine-shaft connected to the piston, inlet and exhaust valves on opposite sides of the cylinder, two substantially straight levers pivotally mounted intermediate their ends upon opposite sides of the cylinder and disposed substantially parallel to the axis of the cylinder, one of said levers directly actuating the exhaust valve and the other directly actuating the inlet valve, a third substantially straight lever similarly disposed and similarly pivoted on the cylinder, a fuel-spray valve on the top of the cylinder substantially concentric with the cylinder, a device located on one side of the spray-valve substantially within the lateral limits of the engine and actuated by said third lever to actuate the fuel-spray valve, an exhaust header for serving the exhaust valve and located on the other side of the spray-valve and substantially within the lateral limits of the engine, two cam shafts mounted on the casing on opposite sides of the cylinder and driven by the engine-shaft and cams on the cam shafts arranged to rock said levers upon their pivots.

1,188,331. June 20, 1916. Fuel Pump of Variable Stroke. H. R. Setz of St. Louis, Mo., Assignor to Fulton Iron Works, of St. Louis, Mo.

This invention relates to a type of a variable feed pump as it is used to-day on the Fulton-Tosi-Diesel engine. The mechanism consists of a fixed-stroke actuating member "D," which is driven by an eccentric crank, or otherwise, a variable stroke member "A," which is in this particular case the pump plunger itself and an interposed connecting device, the little rocker lever "F." This lever "F" which is carried by the fixed stroke member "D" seizes on its upward stroke the pump plunger at a square "6" but it will release the plunger whenever the roller "8" on its upward stroke will hit the tripping block "G." Then the member "D" is rendered inoperative for the rest of the suction stroke and consequently the following actual downward or discharge stroke of the plunger will be reduced by this same amount. The tripping block "G" is operated by the governor of the engine.

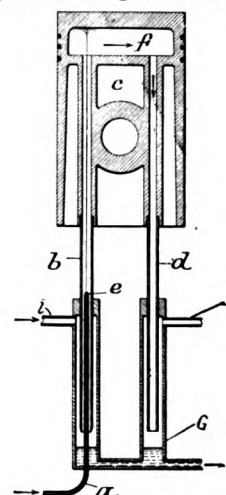


This patent is a modification of and improvement over patent No. 1,204,062.

The inventor claims a variable feed pump provided with a plunger-operating mechanism that comprises a fixed-stroke actuating member, a variable-stroke member, a tripable connecting element arranged intermediate the ends of said variable-stroke member for transmitting movement from the actuating member to the variable-stroke when said actuating member moves in one direction, and a rigid extension on said variable-stroke member that projects beyond said connecting element and whose end is engaged by said actuating member when the latter moves in the opposite direction.

1,051,008. Jan. 21, 1913. Cooling of Pistons. Theodor Reuter of Winterthur, Switzerland, Assignor to Busch-Sulzer-Bros.-Diesel Engine Co., of St. Louis, Mo.

On this cooling device the cooling medium is injected into the piston instead of being forced thro the piston as is customary with the general telescopic pipe ar-

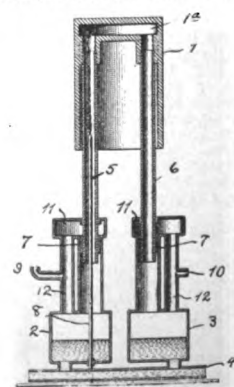


rangement. Thereby backpressure and subsequent leakages of stuffing boxes which are otherwise under pressure are eliminated. The cooling medium after having left the supply nozzle "e" and being splashed against the bottom of the piston will simply drain under atmospheric pressure thro the pipe "d" and any leakage of the inlet will drain thro pipe "b."

The inventor claims the combination of a reciprocating hollow piston having a tube movable therewith and communicating with the interior thereof, said tube also communicating with the atmosphere, and a fixed pipe to inject an air-entraining jet of water through the tube and into the piston.

1,267,702. May 28, 1918. Cooling of Pistons. R. Schlaepfer of Winterthur, Switzerland, Assignor to Busch-Sulzer-Bros.-Diesel Engine Co., of St. Louis, Mo.

This invention is a modification of the above described patent. A stuffing box "7" is added so as to wipe off any moisture which may accumulate on the outside of the telescopic tubes. Furthermore, additional chambers "11" are provided which will collect drops of



water which may pass by the stuffing box and the upper wall of this chamber will prevent lubricating oil of the crank case being drawn into the water system.

The inventor claims that in apparatus of the kind described, the combination of a piston having a cooling chamber, a reciprocating tube connected to the piston, a stationary casing wherein said tube reciprocates, a joint between the outside of the tube and the casing.